the OIL AND GAS JOURNAL

FRANKS *Offers*
The MOST RUGGED Servicing Units
with the
Strongest Heart

The Power Take-off, a Franks *first* in 1931, is what made possible the self-propelled servicing unit, economically using the truck motor for hoist power and providing legal weight units. Franks (split shaft right angle gear box) PTOs, like Franks units, are rugged. Don't take a PTO with less field proven and tested experience than Franks.

Franks PTOs are fully field tested with over 2,000 in use.

Franks units are noted for speediest rig-up and down, fastest location-to-location moving, fastest pulling, ease of operation, trouble-free operation. Here are features of Franks superior derrick type mast:

- ★ **Made of seamless mechanical steel tubing for greatest strength and lightest weight.**
- ★ **Franks rated capacity 100,000 lbs. (gross structural capacity 189,000 lbs.)**
- ★ **Double acting hydraulically raised and hydraulically extended.**
- ★ **Extension lock operates automatically up or down.**
- ★ **Safety check on hydraulics will not allow derrick to drop during raising or extending.**
- ★ **Greater derrick depth provides greater stability.**
- ★ **Tilt adjustment for irregular locations saves rig-up time.**
- ★ **Hydraulic raising devices out of way so there is no impediment to line spooling operation under standard derrick.**
- ★ **Front legs form a straight line from ground to crown.**
- ★ **No guy line rigging to ground necessary.**

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One of four 65 TD Franks Rockets owned by Coon Well Service Co., Liberty, Texas

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Tulsa, Oklahoma

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Only Franks offers "on the spot" field service, with stock of parts and factory trained personnel available at: Alice, Compton, Casper, Farmington, Great Bend, Houston, Kilgore, Odessa, Seminole, Edmonton, and Tulsa.

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FORGED STEEL MANOMETER ASSEMBLY.
EQUI-ANGULAR DIFFERENTIAL LINKAGE.
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STAINLESS STEEL DIFFERENTIAL MECHANISM.
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PRECISION BORED LACQUER FINISHED MERCURY CHAMBER.
MACHINED FLAT TO CHECK MANOMETER LEVEL.
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You are looking at a sectional rear view of the better designed Rockwell "201." Note the lavish use of highest grade materials, the ease of disassembly for servicing, the ready adaptability for interchanging high side chambers. Now, consider the money saving, money earning advantages of using Rockwell "201" orifice meters on all your lines. Full details are given in bulletin 1050. Write for your copy today.

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the OIL AND GAS JOURNAL

MAY 17, 1954 VOL. 53 NO. 2

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In Brief . . .

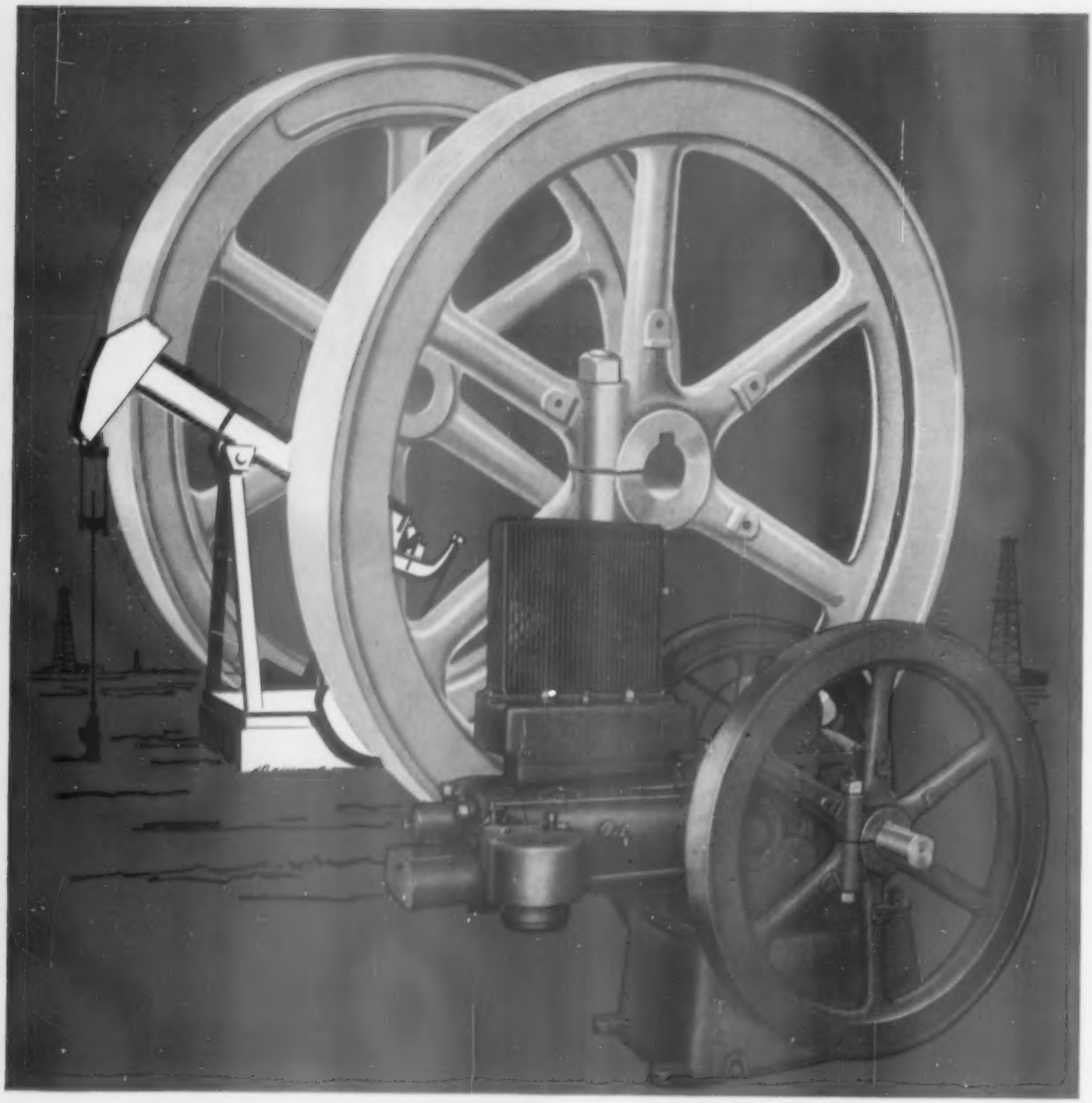
1. ADAPTABILITY . . . Today's markets for petrochemicals change so rapidly that producing plants must be made extremely flexible to take maximum advantage of raw materials, capacity, and product distribution. This article—a three-part discussion—tackles various aspects of achieving this flexibility in reserves, in product capacity, and in marketing. Essentially a roundup of today's most advanced practices in petrochemical-plant design and production, this article is based on papers presented and discussions held at the recent national meeting of the American Chemical Society in Kansas City.

2. BONUS PRODUCTION . . . West Texas engineers have proof that imbibition is a fact, not theoretical fancy. The proof: increased oil production that showed up in wells ¾ mile from Atlantic Refining Co.'s experimental water injection project in the Driver area of the Spraberry Trend. All of these wells lay within the area that would have been flooded out if imbibition hadn't taken place. The only trouble was that Atlantic engineers had a tough time predicting where imbibition would occur! The well they had preselected as their key observation point showed little or no improvement. You'll find the probable reason as you read this.

3. WRONG READINGS . . . Every instrument man knows that the readings of flow-measuring devices can be rendered inaccurate by pulsating flow. The pertinent thing is "why"—why does pulsative flow prevent accurate gas measurement, and what are engineers and instrument designers doing to eliminate it? This article is an analysis of the basic nature of pulsation, a description of some of the devices now being used to minimize it, and an evaluation of recent studies and possible future research on this vexing measurement problem.

4. LOWER COSTS . . . Dual-zone completions offer considerable savings in development costs only if they're employed in the right circumstances. For example, they cut costs when two marginal zones can be combined . . . when an otherwise uneconomic zone can be opened . . . or when maximum production can be achieved earlier than normal by decreasing development time. Here's a boiled-down discussion of dual-zone completions.

5. SHOT CATALYST . . . The Model II fluid hydroformer is a considerable improvement over the Model I, despite many similarities. The big difference lies in a new heat source that operates on the shot-catalyst principle. It's an inert solid stream that circulates with the catalyst between the reactor and the regenerator and conveys into the reactor the heat of regeneration that can't be transported economically by the catalyst itself.



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With a Fairbanks-Morse "ZC" Engine powering your pumper, you're protected against overload. For the famous oversize, extra-heavy *double* flywheels smooth out power surges . . . assure perfect power balance, poised or rolling. With power take-off on either side of the engine, there's always a flywheel between engine and load.

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91% of gasolines surveyed contain significant amounts of copper!

While this is a staggering figure, Du Pont's latest gasoline quality survey shows it to be true . . . indicating that copper contamination resulting in gum formation poses an important problem to most refiners.

A recent Du Pont gasoline quality survey included an analysis of copper content. When the nationwide results were tallied, they revealed some startling information about this gum promoting element.

Out of 241 service station samples obtained in forty-four U.S. and five Canadian cities, *91% contained copper in significant amounts.* The copper content found in these samples ranged from .01 to .90 mg/liter. These figures are highly significant because in many cases, even concentrations of copper below .01 mg/liter have been found to be detrimental to gasoline stability.

Gum content

Because the analytical method used in this survey does not distinguish between free and deactivated copper, the analysis was carried a step further to determine the gum content of each sample. As was to be expected, the gasolines known to contain metal deactivator were low in gum content in spite of high copper concentrations. Conversely, others, without metal deactivator, were found to be high in gum content.

The results of this survey indicate clearly that, in spite of great pains taken to prevent copper contamination during refinery operation, copper is getting into the majority of gasolines sold—probably from contact with valves, pumps and other sources associated with distribution. Based on the gum findings, there are also indications that refiners who are already using a metal deactivator may not be using enough to guarantee maximum stability all along the line.

How can you be sure?..

Du Pont Metal Deactivator was developed especially to prevent copper from accelerating harmful gum formation in gasolines. And in most cases it gives effective protection for less than ¼ cent per barrel.

To help you determine the amount of Metal Deactivator required to assure that your gasoline reaches the customer in refinery fresh condition, one of our conveniently-located regional laboratories will be glad to evaluate its effectiveness in your own stocks. Address your request for this service to the nearest regional office listed below.

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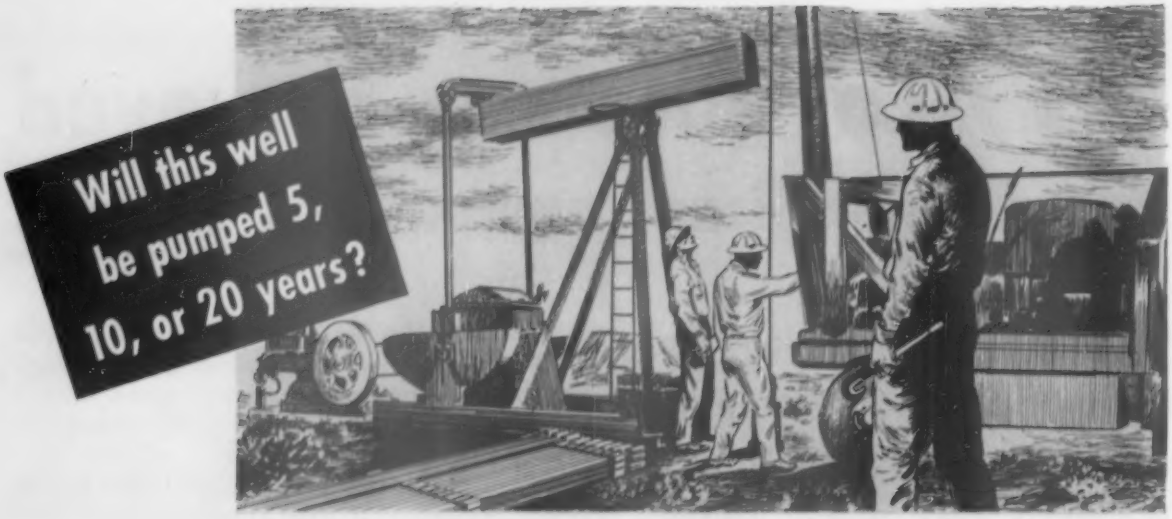

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A MEASURE OF QUALITY

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Keeping Thermal Expansion Under Control

Flexible support for piping in all positions of travel must be provided, if destructive stresses and strains are to be avoided in today's high temperature piping systems.

Heat 100 linear feet of alloy steel pipe to 1000° F, and it will expand 9.1 inches! When this thermal expansion takes place in a piping system, the resultant forces induced, if uncontrolled, can do incalculable harm.

Helical coil springs

The practice of using helical coil springs to allow this thermal expansion to occur is quite general. But the care that goes into the design or selection of flexible supports ofttimes is haphazard. In fact, many specifications covering the support of important high temperature piping will simply say "spring hangers shall be provided". Merely to contend that this may be dangerous is not enough.

Safety of entire system at stake

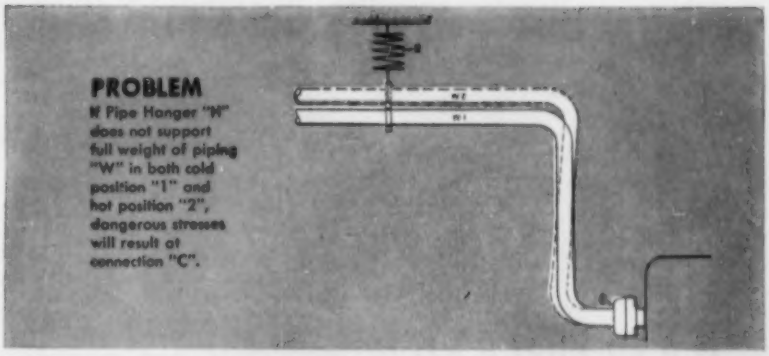
Unless careful study is given to the design and selection of spring supports which will maintain a balanced pipe system, the transfer of weight from one hanger to another, or from a hanger to a terminal point, will endanger the safety factor of the entire system.

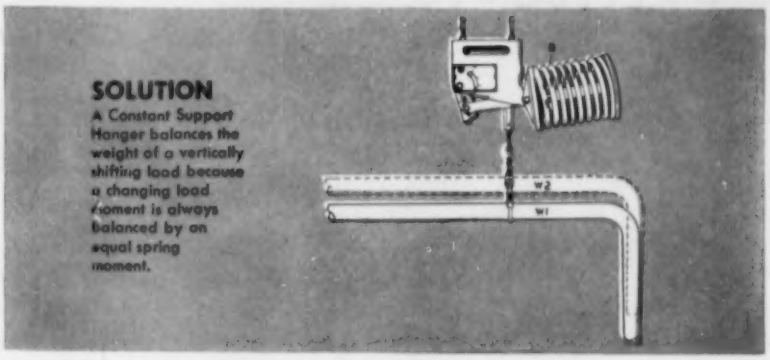
With 8 . . . 9 . . . even 10 inches of thermal deflection not a bit uncommon today, completely flexible support for piping in all positions of travel is a positive "must".

The case for constant-support hangers

Where reactive forces at terminal points in a piping system must be kept within specified limits, constant support type hangers are recommended.

They are designed to provide uniform supporting force equal to the pipe load throughout the travel range and should be used at superheater outlets, turbine connections, and also on high temperature and other critical lines.

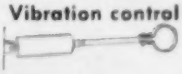

PROBLEM
If Pipe Hanger "W" does not support full weight of piping "W" in both cold position "1" and hot position "2", dangerous stresses will result at connection "C".


SOLUTION
A Constant Support Hanger balances the weight of a vertically shifting load because a changing load moment is always balanced by an equal spring moment.

Variable spring hangers

When pipe lines are subject to vertical movement, and restrictive conditions do not require a constant-support type hanger, variable spring hangers are recommended. They should be designed to support not less than 85%, or more than 120%, of the design load throughout the total travel.

Vibration control and sway brace



When necessary to prevent abnormal movement or vibration in pipe lines, controls or sway braces of the energy-absorbing or instant-acting counter force type, are recommended. They dampen vibration, oppose pipe sway and absorb shock.

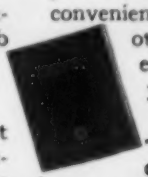
Hanger Engineering Service

The Pipe Suspension Department of Grinnell Company offers a design service to engineering firms which appreciate the specialized knowledge required to compute hanger loads and to select the proper supports for a balanced pipe suspension system when high pressures and high temperatures are involved.

Grinnell manufactures a complete line of pipe hangers and supports; maintains an experienced laboratory staff of technicians to discover better ways of solving pipe suspension problems; provides engineering assistance in design and installation; offers stocks of pipe hangers close to any job.

Hanger load calculation booklet

A 28-page booklet entitled "Hanger Load Calculations", compiled to furnish necessary data and procedure to determine pipe hanger loads, can be obtained from Grinnell Company. The tabulations of piping weights and thermal expansion have been arranged for convenient selection of data that otherwise consume considerable time to develop. It's yours without obligation.



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And here's another advantage that makes it so remarkable— Pozmix costs less! Not only is the original cost cut, but the *long lasting cement* lessens the need for remedial cementing or casing replacement. This is particularly true when perforating follows the cement job, since Pozmix's greater resiliency permits deep, effective penetration with minimum shattering.

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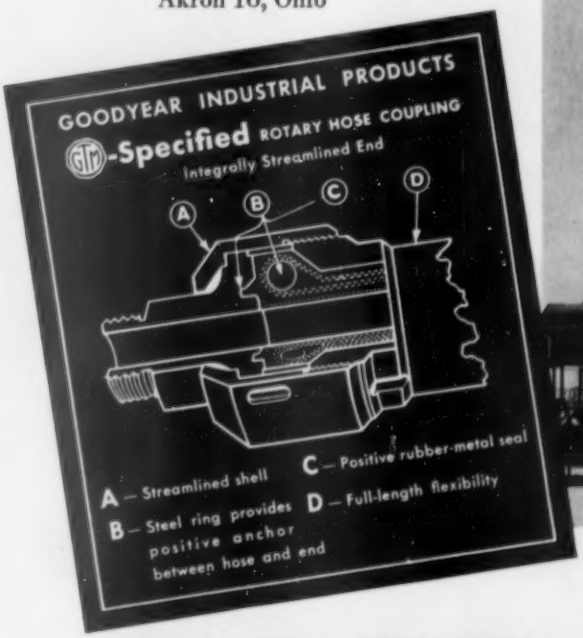

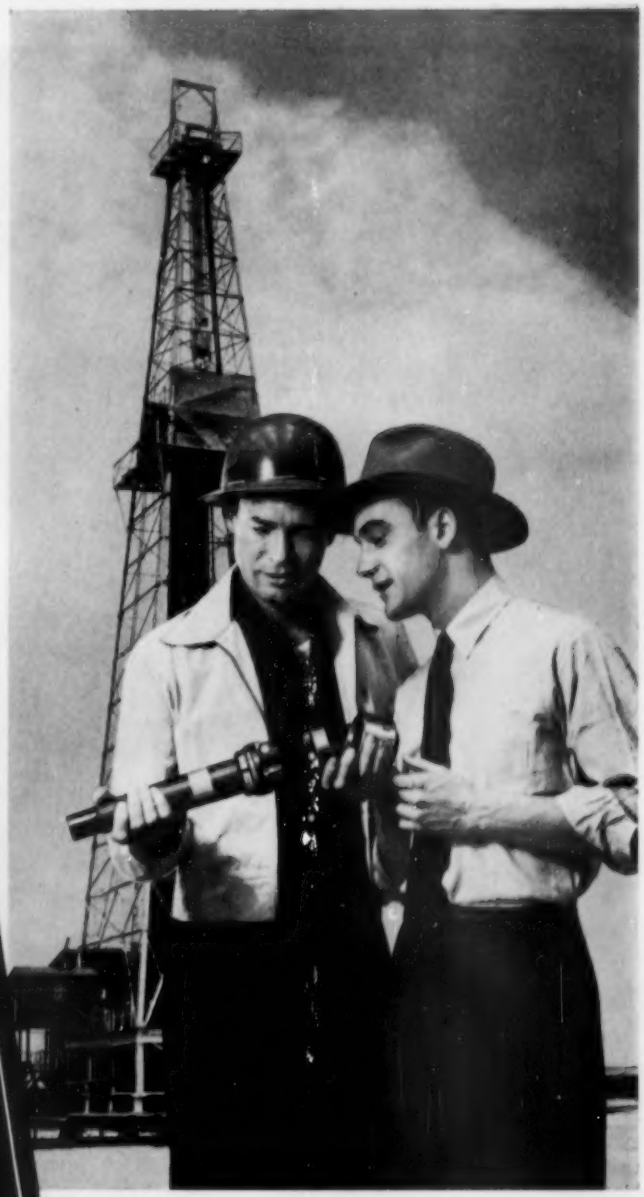

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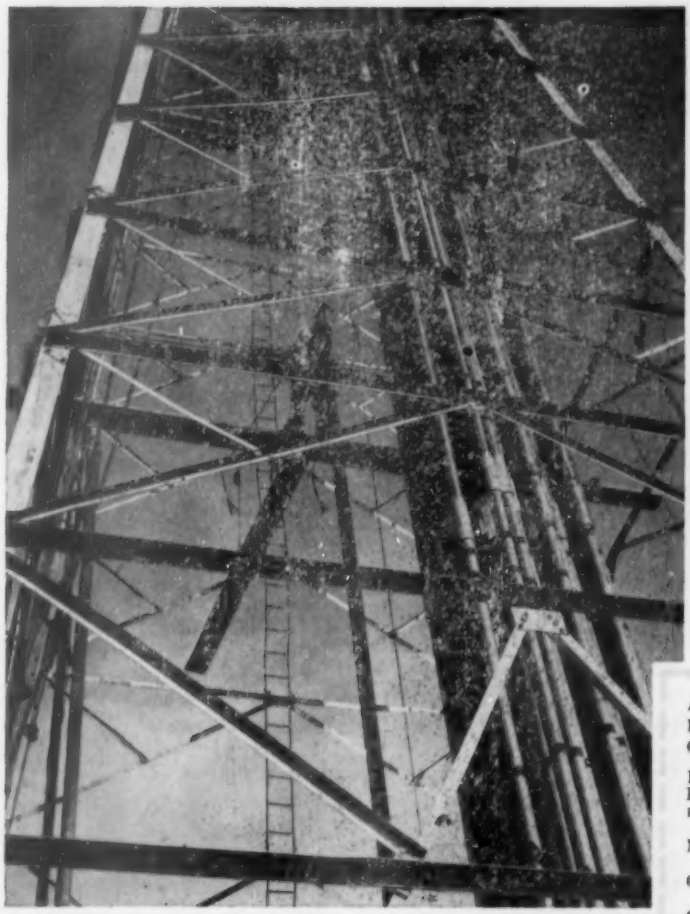

ASK any driller who has used Tiger Brand Wire Lines and he'll tell you how good they are. He'll tell you that they give extremely long, trouble-free service.

We know of one Tiger Brand Rotary Line that gave 89,625 ton-miles of service before it was replaced . . . another that was used on nine wells, for a total of 93,919 ft. of hole . . . and many others that have comparable service records.

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Beech Aircraft Corporation, Wichita, Kansas, U. S. A.

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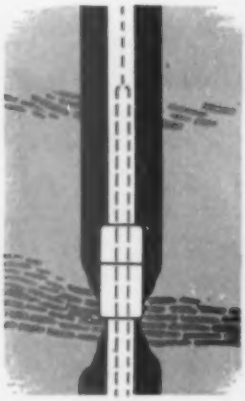
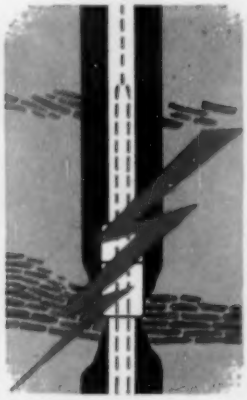
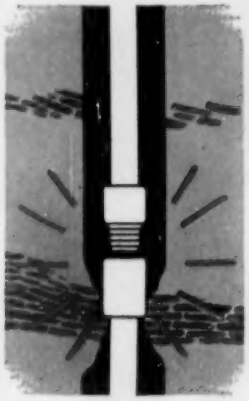
DIA-LOG's *unbeatable combination recovers drill pipe faster than any other method!*



Free Point Indicator locates lowest depth where stretch and torque can be applied on the drill string.



The "String Shot" is lowered to the same depth on the same cable and detonated to loosen tool joint.



Back off recovers stuck drill pipe, drill collars, tubing or casing to permit further fishing operations.

THE DIA-LOG FREE POINT INDICATOR

This tool accurately determines the lowest depth where *both stretch and torque* can be applied to the drill string. It locates the exact point where stuck drill pipe, drill collars, tubing or casing can be freed. Movements as small as *one-thousandth of an inch* are recorded electronically on a surface indicating panel. Since reverse torque is used to back off, pipe to be recovered must be free in torque as well as stretch. *The Dia-Log Free Point Indicator gives you this correct depth in a matter of minutes!*

THE DIA-LOG STRING SHOT BACK-OFF

On the same electric conductor cable used for the Dia-Log Free Point Indicator, a "String Shot Back-Off" is run to the desired depth. Upon detonation, the "String Shot" delivers a sharp jar sufficient to start the unscrewing of the load-free joint. In thousands of successful runs, Dia-Log has recovered *millions* of feet of stuck pipe quickly and economically by employing this infallible combination. The "String Shot" also jars loose stuck tubing packers, frozen overshots, safety joints and stuck liners.

Wherever you are stuck -- Dia-Log Service is available

Dia-Log Service is available in all domestic oil fields. Wire, write or call any Dia-Log Company or Ford Alexander Corporation office for fast, dependable recovery of drill pipe.

Gulf Coast and Mid-Continent

THE DIA-LOG COMPANY

BOX 14103 **HOUSTON, TEXAS**

Odessa, Texas
Hobbs, New Mexico
Farmington, New Mexico
Oklahoma City, Oklahoma
Healdton, Oklahoma
Great Bend, Kansas
New Iberia, Louisiana
Houma, Louisiana
Natchez, Mississippi
El Dorado, Arkansas
Corpus Christi, Texas
Kilgore, Texas

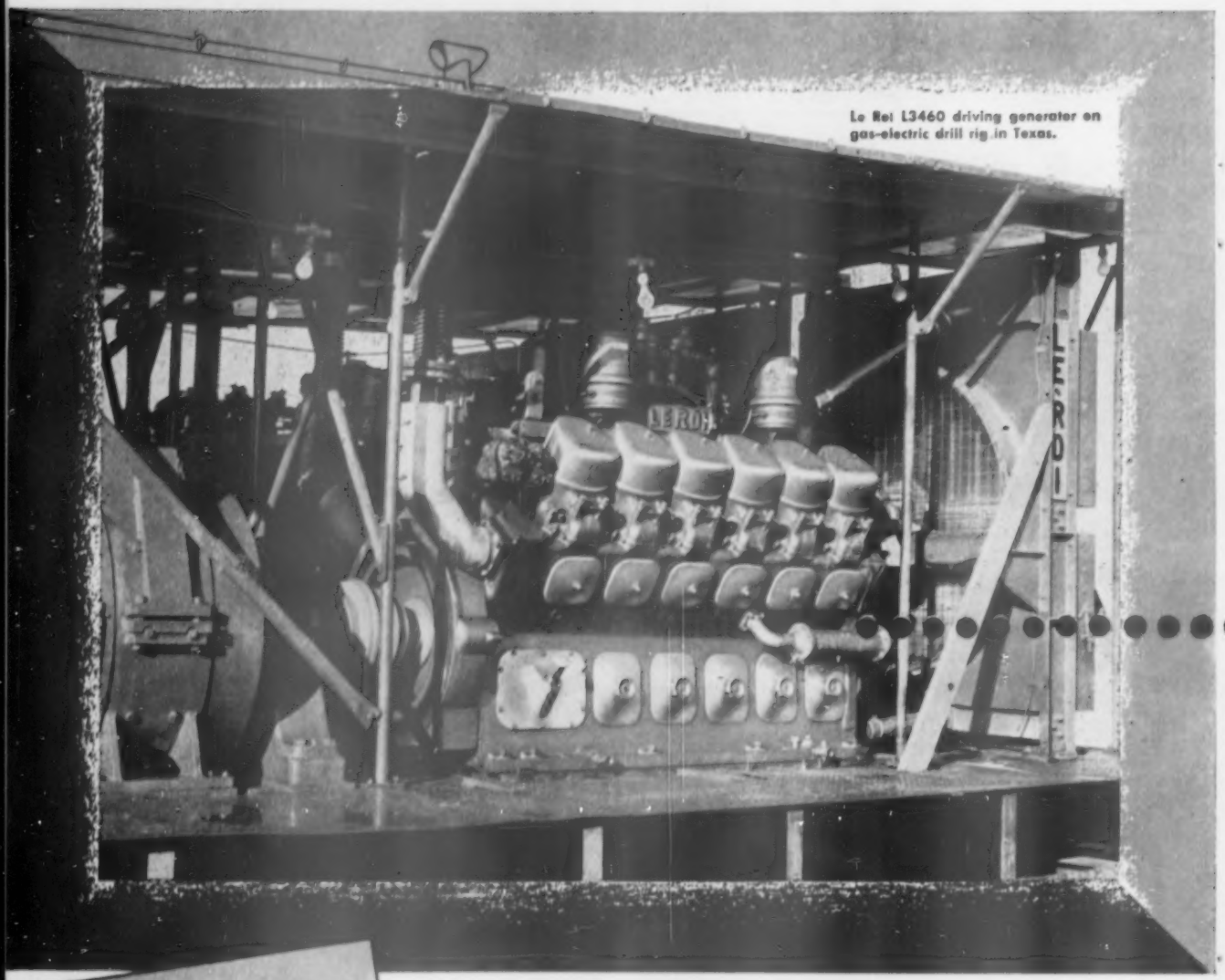
California and Rocky Mountains

THE FORD ALEXANDER CORPORATION

BOX 800 **WHITTIER, CALIFORNIA**

Ventura, California
Taft, California

A drillin' demon



Le Roi L3460 driving generator on gas-electric drill rig in Texas.

OILFIELD SALES-SERVICE NETWORK

Oklahoma
Le Roi Company Branch — Tulsa
Carson Machine & Supply Co. — Oklahoma City

East & South Texas, Gulf Coast
Southern Engine and Pump Company — Houston, Kilgore, Edinburg, Dallas, San Antonio, Corpus Christi, Texas, and Lafayette, Houma, New Orleans, Louisiana.

North & West Texas, New Mexico
General Machine & Supply Co. — Odessa, Snyder, Texas.
Nortex Engine & Equipment Co.—Wichita Falls, Texas.

Kansas
Carson Machine and Supply Co.—Great Bend

Rocky Mountain Area
Gehring Equipment Co. — Casper, Wyoming, Rangeley, Col.

Mississippi, Arkansas and Northern Louisiana
Ingersoll Corporation — Shreveport, Louisiana, El Dorado, Arkansas and Clarksdale, Jackson, Mississippi.

West Coast
Le Roi Engine Sales Co. — Long Beach, California

Appalachian Area
P. C. McKenzie Co., Pittsburgh, Bradford.

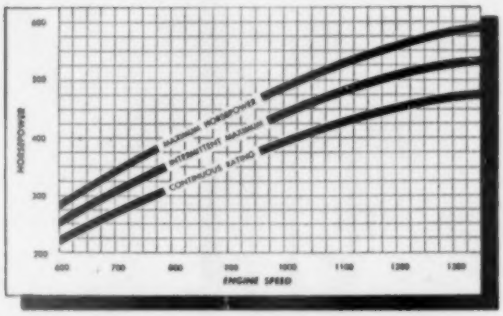
Canada
Lucey Export Ltd. — Calgary, Edmonton, Alberta.

on any rig!

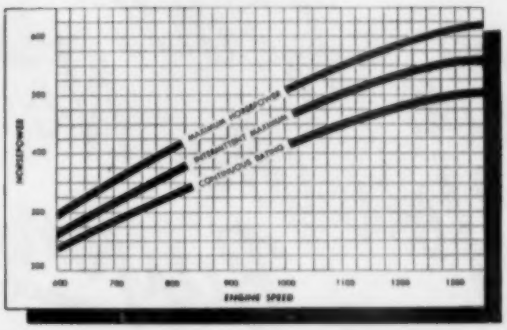
LE ROI L3460

gives you the reserve power, lightning-fast acceleration, and stamina you need for deep holes

Gasoline or natural gas

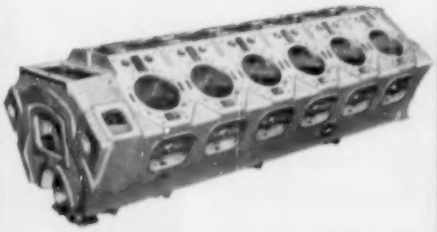


Butane



More Power — Wider Speed Range

Valve-in-head design lets one man remove cylinder heads without disturbing manifold, carburetor, or controls.



One-piece crankcase and cylinder construction provides unusual rigidity—prevents misalignment. An example of how the L3460 is built to take the punishment of oilfield handling.

Replaceable cylinder sleeves do away with costly reboring and expensive oversize parts.

A Le Roi L3460 gives you what it takes to bottom at low cost.

It's a conservatively rated engine. That means there's plenty of power with unmatched acceleration. And when you want this power, you get it right off the bat by just opening the throttle.

The L3460 has many other desirable characteristics: A wide speed range from 600 to 1350 rpm. Horsepower from 350 to 600 max. Dependability and economy under continuous loads. Lugging power at slow speeds. Compactness that helps you stay within overall width and weight limitations. Accessibility that simplifies maintenance.

The L3460 is a versatile engine. It's not only ideal for drilling rigs, but it more than pays its way on other oilfield applications — pumping, power-generation, etc.

Like all Le Roi engines, the L3460 operates on the most economical fuels in the oil fields, natural gas and butane — as well as gasoline.

Ask your supply house or Le Roi distributor to show you the L3460 and other Le Roi engine installations. Make arrangements soon.

LE ROI

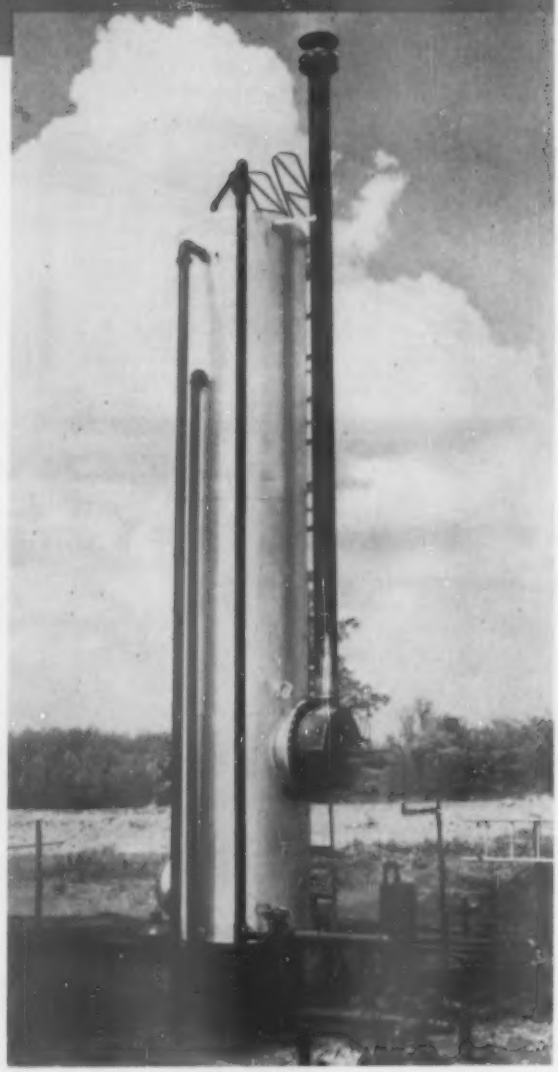
LE ROI COMPANY

A Subsidiary of Westinghouse Air Brake Co.
MILWAUKEE 14, WISCONSIN
Plants: Milwaukee • Cleveland • Greenwich • Dunkirk, Ohio • Coldwater, Mich.
Oilfield Headquarters: Tulsa, Oklahoma

P-130

This Low-Cost M.-C. TREATER

WILL HANDLE PROBLEMS AT 90% OF LOCATIONS



Be Sure You Are Not Over Buying

The Maloney-Crawford IG Type Treater is designed to treat loose type emulsions which require the addition of heat and settling time to break the water out of the emulsion. The IG is a *low cost* treater with a large oil settling area; free water knockout section; over ample furnace; 25 lb. working pressure; high siphon location discouraging tampering after level is set.

If your problem is within the 90 percent of cases where this IG treater will work satisfactorily, you will save money by using it. Call a Maloney-Crawford representative to see if it will solve your problem.

MALONEY CRAWFORD

MALONEY-CRAWFORD TANK & MFG. CO.

FACTORY AND GENERAL OFFICE: 38 North Peoria—Box 659—Tulsa, Oklahoma
EXPORT REPRESENTATIVE: Baird Lines, 420 Lexington Avenue, New York, N. Y.
CANADIAN REPRESENTATIVE: Maloney-Crawford Tank & Service Company, Ltd., Edmonton, Alberta
TEXAS PANHANDLE REPRESENTATIVE: Atlas Tank Company, Pampa, Texas.

just a

TWIST

of the wrists

snap-locks

NEW *Eastco* DRIFT INDICATOR BARREL

Another Eastman FIRST . . . the quick action, positive SNAP-LOCK Drift Indicator Barrel requires no wrenches. Just a twist of the wrists is all that's needed for locking this new barrel. Eastman Engineers have designed the Stainless Steel SNAP-LOCK Barrel to operate under any and all conditions. Maximum protection for the instrument is assured through the use of shock absorbers both inside and at the lower end of the barrel. This New Eastco SNAP-LOCK Barrel can be GO-DEVILED or run on a WIRE LINE.

YOU CAN DEPEND ON EASTMAN FOR FAST, DEPENDABLE, AND EFFICIENT SERVICE

26 offices for your convenience consult your Telephone directory

DIRECTIONAL DRILLING Eastman OIL WELL SURVEYS

Eastman Oil Well Survey Company

LONG BEACH DENVER HOUSTON

Export Sales and Service

EASTMAN INTERNATIONAL COMPANY

P. O. Box 1500 • Denver, Colorado

YOU CAN *Specify* MINIMUM MAINTENANCE COSTS WITH *Amercoat* PROTECTIVE COATINGS

ONLY AMERCOAT PROVIDES YOU WITH

The most complete line of corrosion resistant coatings available anywhere

Field service backed by an organization SPECIALIZING in corrosion control

The service life of your equipment—the efficiency of your production schedules — the ultimate value of your investment and maintenance dollars — all are vitally dependent on the continuing performance of the protective coatings specified in your plant. Thus, success or failure of your coatings can mean the difference between tremendous losses or substantial savings.

To assure coating performance that provides long-lasting, low-cost protection, two steps are absolute essentials, right from the start. You need the right coating for each specific exposure, and it must be applied properly if it is to yield maximum benefit.

AMERCOAT ELIMINATES THE GUESSWORK—MINIMIZES MAINTENANCE COSTS

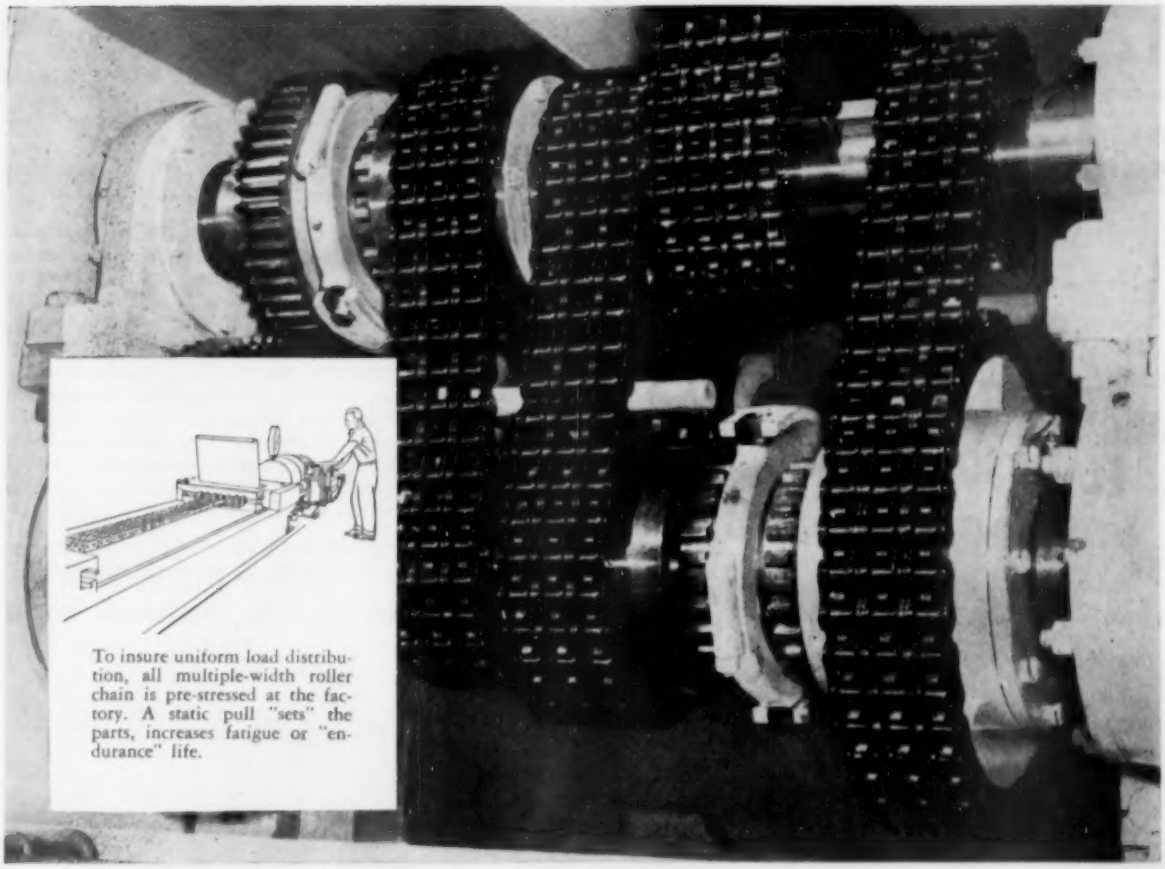
First of all, AMERCOAT provides the right coating for the particular problem. From the complete AMERCOAT line, it is possible to provide specific coatings for specific exposures to achieve specified protective performance.

In addition, you receive the added value of AMERCOAT's conscientious service follow-through backed by an organization SPECIALIZING in industrial corrosion control. With the assistance and on-the-spot advice of a trained representative, you get the best possible application through proper attention to surface preparation and correct coating techniques.

Investigate AMERCOAT now. It's your surest way to effective, long-term corrosion control. An experienced representative is near you to serve you. For complete details write today.

Amercoat CORPORATION
4809 Firestone Blvd., South Gate, Calif.

CHICAGO, ILLINOIS
KENILWORTH, NEW JERSEY
JACKSONVILLE, FLORIDA
HOUSTON, TEXAS



To insure uniform load distribution, all multiple-width roller chain is pre-stressed at the factory. A static pull "sets" the parts, increases fatigue or "endurance" life.

Pre-stressing pays off in longer roller chain life!

But it's only one of many engineering extras you get from LINK-BELT

SEVERE requirements of oil field service often result in heavy over-loads. But the pre-stressing of Link-Belt Precision Steel Roller Chain increases its fatigue strength and gives it added ability to absorb these over-loads. This results in longer chain life.

However, the long service record of Link-Belt Precision Steel Roller Chain is based on more than the pre-stressing process. Extra-wear features such as shot-peened rollers and the uniform hardness of parts are further assurance of Link-Belt's *built-in* extra service life.

LINK-BELT

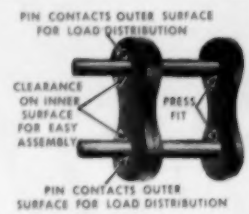
13.448

ROLLER CHAIN and SPROCKETS

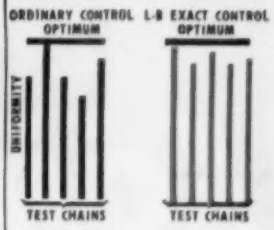
LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 1, Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

Don't overlook these other LINK-BELT extras

Shot-peened rollers have extra fatigue life under impact.


PIN CONTACTS OUTER SURFACE FOR LOAD DISTRIBUTION
CLEARANCE ON INNER SURFACE FOR EASY ASSEMBLY
PRESS FIT
PIN CONTACTS OUTER SURFACE FOR LOAD DISTRIBUTION

Couple and uncouple multiple-width chains more easily.



Closer heat treat control helps attain greater uniformity.

EL PASO NATURAL GAS

4 LORAIN TL-25 HOES DIG THROUGH TOUGH ROCK ON EL PASO NATURAL GAS PIPELINE JOB!

The El Paso Natural Gas Co. is using four Lorain TL-25 Hoes to dig trench on a section of their 30" natural gas pipeline from the Permiam basin near Midland, Texas, to Topock, Arizona. Here, two of them are shown working back to back on a rocky stretch in northern New Mexico. They are digging trench 44" to 65" deep through blasted sandstone and granite and averaging about 400 ft. of trench per shift per machine.

Wherever pipelines go, Lorains go with them. Lorains were designed to meet the needs of pipeliners with the features they most needed and wanted — features such as special, extra-long and extra-wide crawlers to straddle trenches with maximum stability, easy-dumping hoe buckets, tread-travel locks conveniently and power operated from the cab, replaceable tread pin bushings, sealed idler rollers, convenient towing hooks . . . these are important reasons Lorains better serve the needs of pipeliners at bigger savings. Too, Lorain offers the most complete selection of crawler or rubber-tire mountings, capacities and front ends to fit your pipeline requirements.

Thew-Lorain Distributors across the country bring fast service to your job. Call on them for facts and figures!

THE THEW SHOVEL CO., LORAIN, OHIO

LORAINS SERVE ALL PHASES OF THE OILFIELD INDUSTRY

Pipeline work is but one of the fields that Lorains fit to a "T". Because the Lorain line is so complete, it can serve all phases of the petroleum industry. There are Lorains on rubber for mobile work around the refinery, Lorains on crawler mountings to meet any terrain conditions. Crane capacities from 6 to 61 tons — shovel-dragline-clamshell capacities up to the 2 yd. class for any excavation or material handling duty.

THEW LORAIN®

CATFORMING *means*

High Octanes...
High Yields...
Low Cost...
Proved Performance

These advantages of Atlantic Catforming are being demonstrated again and again in different commercial installations. We invite you to share in the benefits of Catforming. Please phone, write or wire for our detailed brochure, "CATFORMING." The Atlantic Refining Company, Research and Development Dept., P. O. Box 8138, Philadelphia, Pa.

ATLANTIC *It's the Catalyst that counts*

IT BEGAN WITH A RAFT AND A BOLD ARMENIAN

ABOUT 500 years B.C., an Armenian merchant, looking for new markets, resolved to take a "capital risk".

He loaded a raft with stretched-hide containers of asphalt and bitumen, plus a half dozen asses, and floated hundreds of miles down the Euphrates to Babylon.

His venture paid off. He sold his wares at a profit, and he and his crew rode home on the backs of their animal passengers.

So was taken the first step in the water transportation of petroleum products.

Some 2,400 years after, the latest step is taken:

April 20, 1954, saw the launching of the first of four Cities Service super tankers as queens of the world's oil carriers, the latest additions to the Cities Service fleet. Their size and appointments should make even today's tanker men—much less our Armenian friend—gape with astonishment.

They will carry more oil in less travel time than any other tankers in service today. Air-conditioned, with individual staterooms for all, they'll have crew comforts and conveniences never before seen on tankers.

They will be, in short, the latest word in oil transportation. Not the "last word"—for there is no such thing. (The Armenian probably thought *he* had it!)

The four new "luxury liners" of the Cities Service fleet are merely the latest chapter in a long, long story ... AND THE END IS NOT YET.

CITIES SERVICE

Quality 5-D Products

Facts prove the economy of RUST-OLEUM®

Apply Directly Over Sound Rusted Surfaces

Just scrape and wirebrush to remove rust scale and loose particles — then brush Rust-Oleum 769 Damp-Proof Red Primer *directly over sound rusted surface.*

Lasts Longer Applied Directly Over Rust

Sandblasting, chemical pre-cleaning and other costly preparation methods are *not* usually required. Rust-Oleum penetrates the rust to bare metal, incorporating the rust particles into the coating.

Many Colors, Including Aluminum, and White

Rust-Oleum finish coatings incorporate the same basic rust-inhibiting vehicle as Rust-Oleum 769 Damp-Proof Red Primer. They provide *double protection* and enable you to *beautify as you protect.*

Practical Answer to Your Rust-Producing Conditions

Rust-Oleum resists rain, snow, heat, fumes, sun, salt water, and chemicals. So easy to use by brush, dip, or spray that one man often does the work of two.

Proved Throughout Industry for Over 25 Years

Indoors and out, Rust-Oleum has *proved* its capacity to stop rust! Rust-Oleum can do the same for your tanks, metal sash, stacks, girders, roofs, buildings, machinery, pipes, etc.

An Exclusive Formula

Rust-Oleum is *distinctive* as your fingerprint. It incorporates a specially-processed fish oil vehicle that *dries*, is odor-free, and is formulated in *many colors.* Specify Rust-Oleum — accept no substitutes.

There Is Only One Rust-Oleum

RUST-OLEUM STOPS RUST!

See local classified telephone directory under Rust Preventives or Paints for nearest source of supply.

ATTACH TO YOUR LETTERHEAD — MAIL TODAY!

RUST-OLEUM CORPORATION
2541 Oakton Street, Evanston, Illinois

- ☐ Have a Qualified Representative Call
- ☐ Free Survey
- ☐ Complete Literature
- ☐ Nearest Rust-Oleum Industrial Distributor

• ADVERTISEMENT • PREPARED BY JOHNSTON TESTERS, INC.

JOHNSTON drill stem testing NEWS

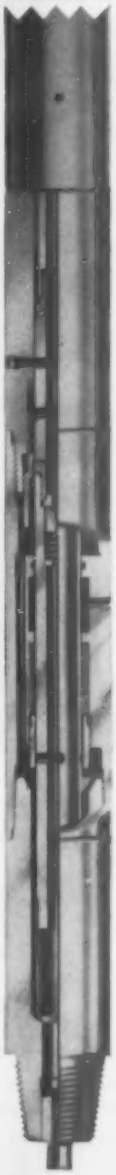
Items of interest to the members of the oil industry

MAY 1954

JOHNSTON SCORES ANOTHER FIRST!

New, Field-Proven BOB TAIL PACKER and HYDRAULIC TESTER Assure More Successful Tests

This Super-Accurate Testing Team gives more reliable drill stem tests than ever before possible—try it, see the difference it makes—faster going in the hole—faster coming out and a big increase in successful, conclusive tests.



NEW BOB TAIL PACKER

. . . proved perfect in hundreds of tests in the field, completely prevents extrusion or flow of the rubber packing! Here's how it works:

1 **Up to 3 Times More Clearance is possible** when going into the hole! The Bob Tail Packer can effectively use a smaller diameter rubber for extra clearance because there's no loss of rubber volume to extrusion!

2 **Pack-Off Is Up To 30% More Effective** since metal petal cups at base of packer **hold** the rubber in the pack-off zone!

3 **Removes Easily From The Packer Seat** after the test because the rubber is supported and contained in the pack-off zone. The assembly is removed intact.

Type B HYDRAULIC TESTER

. . . prevents shock to formation, pipe and instruments and needs less water cushion!

Releases Pressure Slowly below the packer, thereby preventing shock to the test zone! The Type B Hydraulic Tester opens smoothly in stages during 2½ to 4 minutes! It's easy to spud through tight spots that may occur in open or uncased holes!

Positive Operation, Positive Interpretation! The compact, self-contained Johnston Hydraulic Tester opens easily by applying drill pipe weight, closes simply by removing weight! Functions accurately—reduces plugging and damage to wall of hole!

For The Accurate, Reliable DST service that you want, call Johnston Testers—the leader in new and improved DST technique since 1927.

JOHNSTON TESTERS

first in drill stem testing

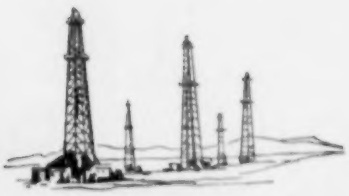
HOUSTON, TEXAS

LOS ANGELES, CALIF • CALGARY, CAN.

FORMATION AND CASING TESTING — JOHNSTON

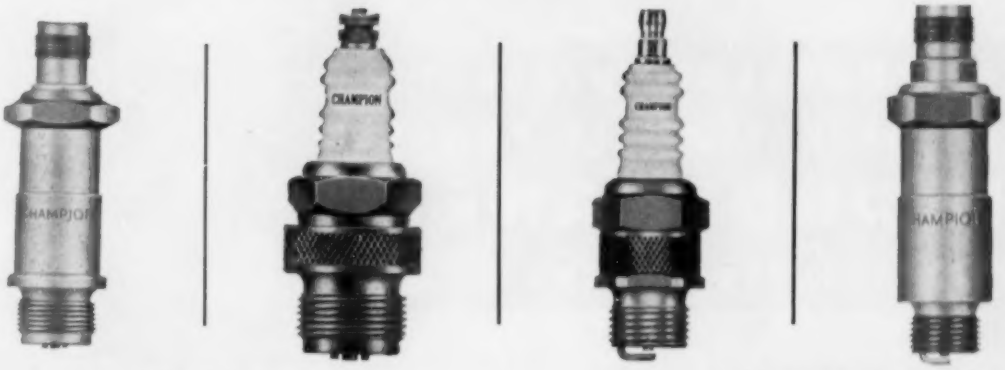
CO-541

CHAMPION

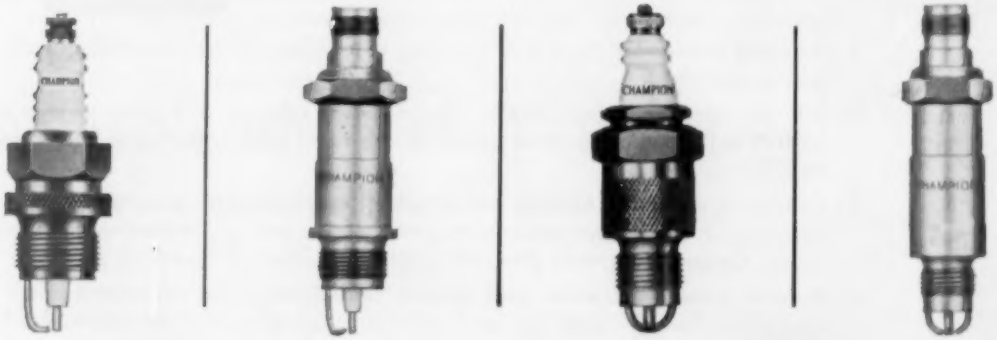


INDUSTRIAL AND OIL FIELD SPARK PLUGS ARE ENGINEERED AND BUILT BETTER TO

Do a Better Job for You!



E-901 GAS ENGINE 901 6 COM. GASOLINE UNITS E-6 COM.



44 DIESEL STARTING E-44 D-8 HESSELMAN ED-8

Shielded or unshielded to best suit your safety requirements, Champions are precision engineered for the specific job and have earned a reputation for long, trouble-free service life under the toughest conditions.

Only Champion offers a complete line of spark plugs for all industrial and oil field engines, gasoline, natural gas, Hesselman and diesel.

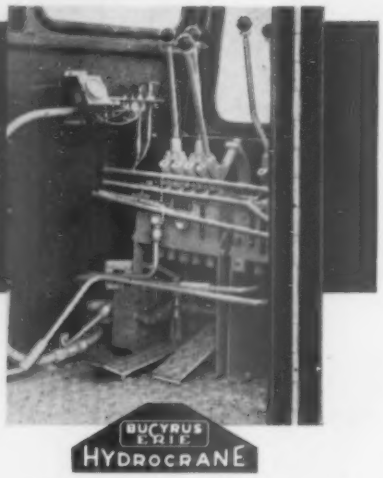
BEST FOR ANY ENGINE

CHAMPION

SPARK PLUGS

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

BUCYRUS-ERIE presents NEW UP-RATED SELF-POWERED HYDROCRANE with selector valve



Now Bucyrus-Erie offers a new, more powerful all-hydraulic crane-excavator — the self-powered H-3 Hydrocrane. Taking its power from its own 4-cylinder industrial engine instead of from the truck engine, the new self-powered Hydrocrane provides the following big advantages:

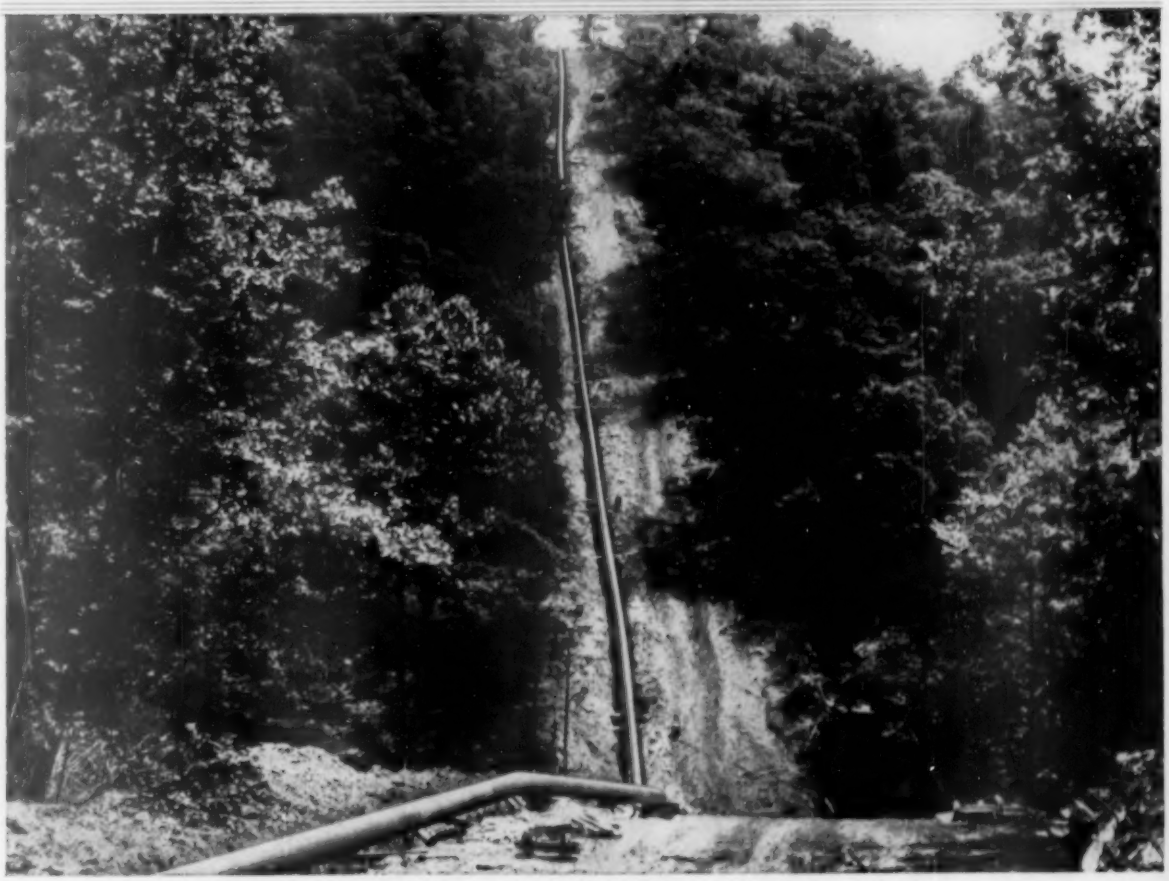
1. **Increased horsepower** through eliminating restrictive influence of side-mounted truck power take-off.
2. **Selector valve operation.** Power concentration selector unit permits channeling hydraulic fluid from all three pumps to one valve bank — increases line speeds up to 50%.
3. **Convenient operation.** Selector valve is foot operated — provides metered control of higher speeds—operator need not let go of hoist and swing levers to operate selector valve. Controls for power plant conveniently grouped at operator's station.
4. **Reduced crane maintenance** from simpler more direct power application. High pressure hoses through center pin leading from pumps to valve bank eliminated. Fewer belts, shafts, and hoses.
5. **Improved efficiency.** Improved oil filtering with less restriction. Better cold weather performance.
6. **Improved truck engine life.** Economy results from fewer truck repair bills. Generator for independent power plant re-charges motor truck battery. Overall fuel consumption is less.

1H54

These are just a few of the advantages of the new self-powered Hydrocrane — and self-power is just one of the big features that is making the Hydrocrane foremost in 1954. See your distributor for complete details.

Bucyrus-Erie Company
South Milwaukee
Wisconsin, U.S.A.

PIPE LINE PROGRESS



26-inch line ready to be lowered in on Cobb-Rockville section of Columbia Gas Systems line.

Columbia Gas Systems Looping "Toughest Inch" with A. O. SMITH 26-INCH LINE PIPE

In the memory of the men who built it, the 262-mile Cobb-Rockville Line, now carrying natural gas from Charleston, West Virginia, to Washington, D.C., is still the "toughest inch." It was completed in December of 1949 through some of the roughest terrain for laying pipe ever encountered.

The "toughest inch" consists mainly of A. O. Smith internally expanded, 26-inch welded steel line pipe.

A portion of this line is now being looped with additional A. O. Smith 26-inch line pipe . . . evidence of satisfaction in our large-diameter welded pipe.

Again the pipe liners are conquering the "roller coaster" grades, rocky terrain, violent streams and stubborn tangle of brush to assure adequate gas supply at the Rockville terminal of the "toughest inch."

A. O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝-in. to 36-in. diameters.

The A.O. Smith Casing Mill is operating at capacity to supply vitally needed casing for the Oil and Gas Industry.

Through research . . . a better way

A.O.Smith

CORPORATION

TUBULAR PRODUCTS DIVISION

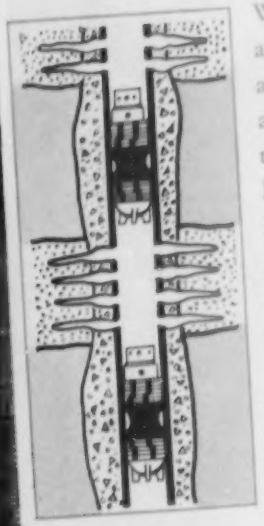
Milwaukee 1, Wisconsin

Chicago 4 • Dallas 2 • Houston 2 • Los Angeles 22 • Midland 5, Texas • New Orleans 12 • New York 17 • Pittsburgh 19 San Francisco 4 • Seattle 1 • Tulsa 3 • Washington 6, D.C.

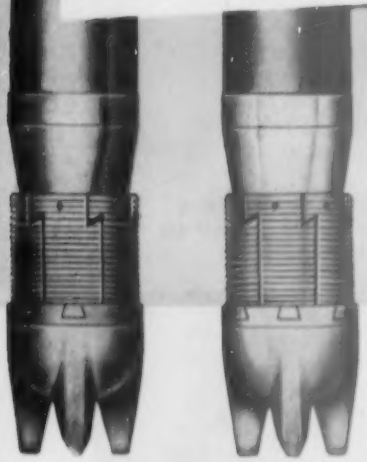
International Division: Milwaukee 1

Something to tack up and remember!

How to save many hours in rigtime when testing multiple zones:



When several zones are to be perforated and tested individually, the combination of Lane-Wells Bridging Plugs and Perforating equipment gives extremely quick and efficient results. The usual method is to perforate and test the lowest zone, set a plug above and repeat the process for each zone above. After testing, the plugs may be drilled out or knocked to bottom after the zone above has been tested. As many as 18 separate zones in a single well have been tested in this manner.



All across the oil country, operators report that Lane-Wells Drillable Wireline Bridging Plugs are the most satisfactory answer to down-hole operations, ranging from abandonment to casing recovery.

That's because operators have proved, for themselves, that these plugs run fast through fluid (due to greater clearance), set tight and hold against pressures either up or down (due to the big interlocking slips), and give leakproof packoff (the extra-long sealing element!) *Magnesium plugs* are rated to 6,000 p.s.i. and drill out in 1 to 3 hours; *cast iron plugs* are rated to 10,000 p.s.i. and drill out in 4 to 6 hours.

Write for more information on Lane-Wells Wireline Drillable Bridging Plugs

LANE WELLS COMPANY

Wireline-Drillable BRIDGING PLUGS

Tomorrow's Tools - Today!®

General Offices, Export Office, Plant • 5610 So. Soto St., Los Angeles 58

LOS ANGELES • HOUSTON • OKLAHOMA CITY

LANE-WELLS CANADIAN CO. IN CANADA • PETRO-TECH SERVICE CO. IN VENEZUELA

AU-704

WHAT CAN BE SAID FOR . .

. . HOSE

ARTERIES OF INDUSTRY . . .

Hose is common, yet complex. Into the tube, carcass and cover of these flexible pipelines may be blended natural or synthetic rubber, plastic, textiles, wire and a wide variety of chemicals. When the ingredients are properly combined and processed, these arteries of industry will withstand high pressures, abrasion, flexing and temperature extremes . . . while handling air or gases, acids or alkalies, oil or vinegar, mud or molasses, steam or sand.

PULSEBEAT OF PROGRESS . . .

More important than the ingredients of industrial hose is the ingenuity of the myriad of scientists and engineers whose ceaseless search for new and better products is the heart of America's progress.

—from an advertisement by McGraw-Hill Publishing Company, Inc.

J & L RECOMMENDS REPUBLIC FOR ROTARY DRILLING

Hose is, as McGraw-Hill so ably indicates, one of the modern wonders of the industrial world.

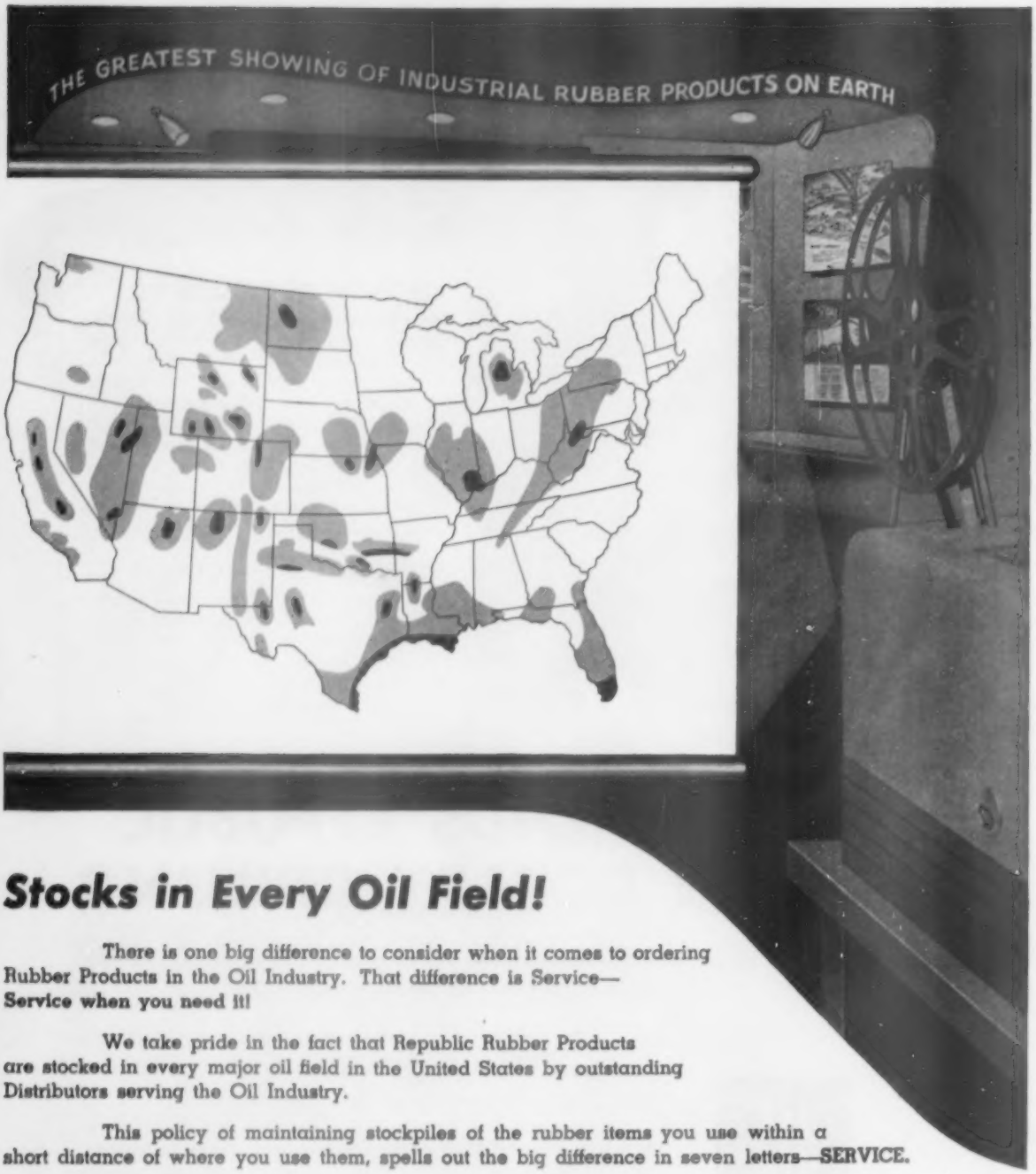
But at that, it pays to be brand conscious in selecting hose for rotary drilling. It's a tough job, and failure can involve so much more than just the hose.

We recommend Republic's Champion grades. It seems apparent to us, and to many J&L customers, that Republic hose makes more hole with greater safety. Even the patented coupling is an important advantage to our Republic customers – the higher the pressure, the tighter the seal.

Ask any J&L man to give you local examples of Republic endurance and performance.

J&L STEEL

Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION —— TULSA
Serving The United States and Canada



Stocks in Every Oil Field!

There is one big difference to consider when it comes to ordering Rubber Products in the Oil Industry. That difference is Service—**Service when you need it!**

We take pride in the fact that Republic Rubber Products are stocked in every major oil field in the United States by outstanding Distributors serving the Oil Industry.

This policy of maintaining stockpiles of the rubber items you use within a short distance of where you use them, spells out the big difference in seven letters—**SERVICE.**

Rotary Drilling Hose
Vibrator Hose
Mud Pump Suction Hose
Wiretex Safety Steam Hose
Gasoline Hose
V Belts
Oil Country Transmission Belting
Water Hose
Oil Suction and Discharge Hose
Tank Unloading Hose

Stocked in the MID-CONTINENT AREA By Jones & Laughlin Steel Corporation, Supply Division P.O. Drawer 2481, Tulsa 2, Okla. and the J & L Store in YOUR field.

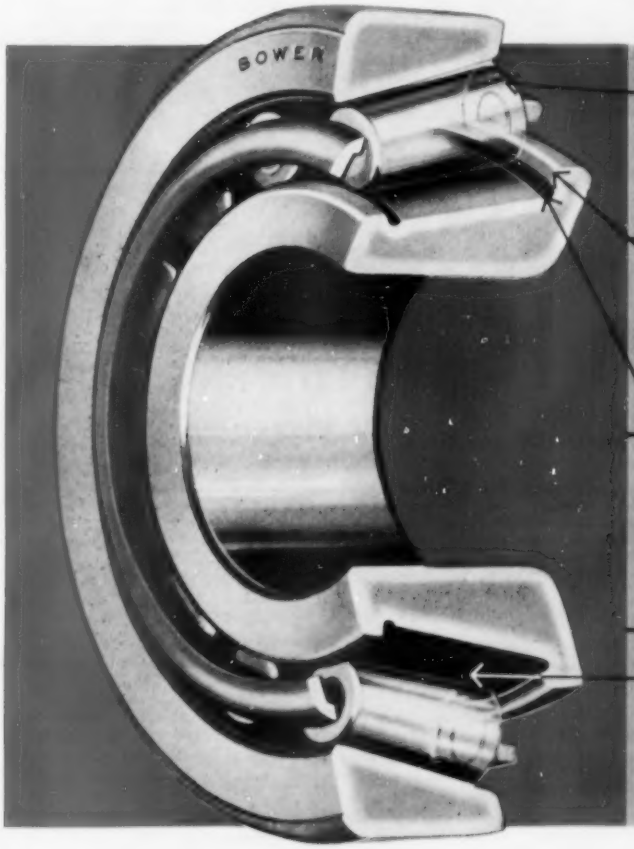
REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
INDUSTRIAL RUBBER PRODUCTS

Stocked on the WEST COAST By Hendrie Belting & Rubber Co. 405 Towne Ave., Los Angeles, Calif. Pacific Coast Rubber Company 51 Main St., San Francisco, Calif.

Here's how BOWER Spher-o-honed design lengthens bearing life... cuts maintenance costs!

The Bower tapered roller bearing design features shown on this page are vitally important to every bearing user. For they illustrate the high quality, precision workmanship and close attention to engineering detail that go into *every* Bower bearing. Even more important, these Bower design features will give you significant bearing advantages such as reduced wear, longer bearing life and lower maintenance requirements. They've been thoroughly *proved* by extensive use in virtually every type of bearing application. If your product uses bearings—whatever it may be—specify Bower now. Or better yet, call in a Bower engineer while your product is still in the blueprint stage.

BOWER ROLLER BEARING COMPANY • DETROIT 14, MICHIGAN



● **SPHERICAL ROLLER HEADS ARE GENERATED TO THE CONTOUR THEY ACQUIRE IN THE COURSE OF WEAR.** This helps Bower bearings hold adjustment and pre-load longer and better. Normal running-in time is virtually eliminated.

● **HIGHER FLANGE PROVIDES A LARGE, TWO-ZONE CONTACT FOR ROLLER HEADS,** thereby reducing unit pressure. This exclusive Bower feature improves roller alignment, greatly reduces wear and practically eliminates resultant "end play."

● **LARGER OIL GROOVE GIVES POSITIVE LUBRICATION** at the critical point—where the roller head thrusts itself against the cone flange. Here Bower design provides a larger recess that holds a generous supply of lubricant—increasing efficiency and decreasing wear.

● **PRECISION RACES PROVIDE QUIETER, SMOOTHER OPERATION.** A Bower-developed grinding and honing process provides a micro-smooth surface of hard, crystalline base metal. In this way, close-tolerance precision is built-in to stay! No final adjustment is needed!

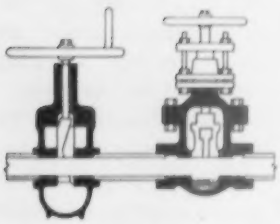
A COMPLETE LINE OF TAPERED, STRAIGHT AND JOURNAL ROLLER BEARINGS FOR EVERY FIELD OF TRANSPORTATION AND INDUSTRY

BOWER ROLLER BEARINGS

SPHER-O-HONED

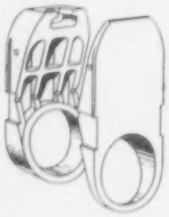
12 Reasons

why WKM Valves are your best buy for any service

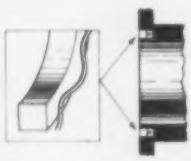


1 **Through Conduit Design** . . . prevents foreign matter from jamming valve, provides smooth, turbulence-free flow, eliminates conventional pressure drop.

2 **Renewable Seats** . . . one- and two-piece seat and skirt assemblies are easily renewable, even while the valve is on the line.



3 **Chrome Plated Gates** . . . W-K-M gates are ground and chrome-plated for a smooth, hard finish. Gates with inlaid seats or made of special alloys are available.

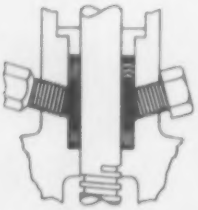


4 **Spring-Loaded Seal & Wiper Rings** . . . bear against the gate and segment at both seats wiping the gate surfaces clean at each operation and also serve to prevent loss of lubricant in operation.

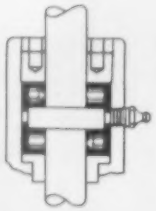
5 **Superfinished Stems** . . . with ground threads for easy handwheel operation even under high packing pressure.

6 **Parallel Expanding Gates** . . . are the basic secret of W-K-M Valves' success. This design, developed by W-K-M, makes possible full conduit flow, positive shut off on both sides and most of the other advantages shown on this page.

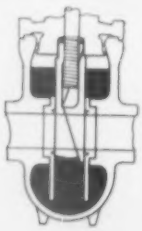
7 **Pressure Seal Bonnet** . . . eliminates bonnet flanges and studs, self-adjusts to temperature changes and seals tighter as the pressure goes up.



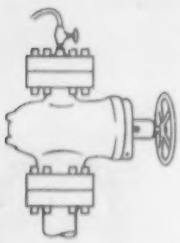
8 **Combination Plastic and Chevron Packing** . . . requires no gland or follower and keeps the packing within the stem enclosure free from dirt and contamination.



9 **Double Row Thrust Bearings** . . . take opening and closing thrust thus contributing to the easy opening and closing of W-K-M Valves.



10 **Automatic Lubrication** . . . is provided by filling body cavity with grease. Often this amount of grease is a lifetime supply.



11 **Careful Testing** . . . in the shop assures perfect performance in the field. Standard A.P.I. test procedure is used.

12 **Easy Field Repair** . . . while on the line. The entire valve may be overhauled while on the line with pressure off. Stems or bonnets may be replaced while valve is under pressure, if necessary.

No other standard valve offers so many features so important to trouble-free operation. If you need special-service valves, this basic valve is offered plus added features such as teflon seats, super-fast operators and special trim for any service.

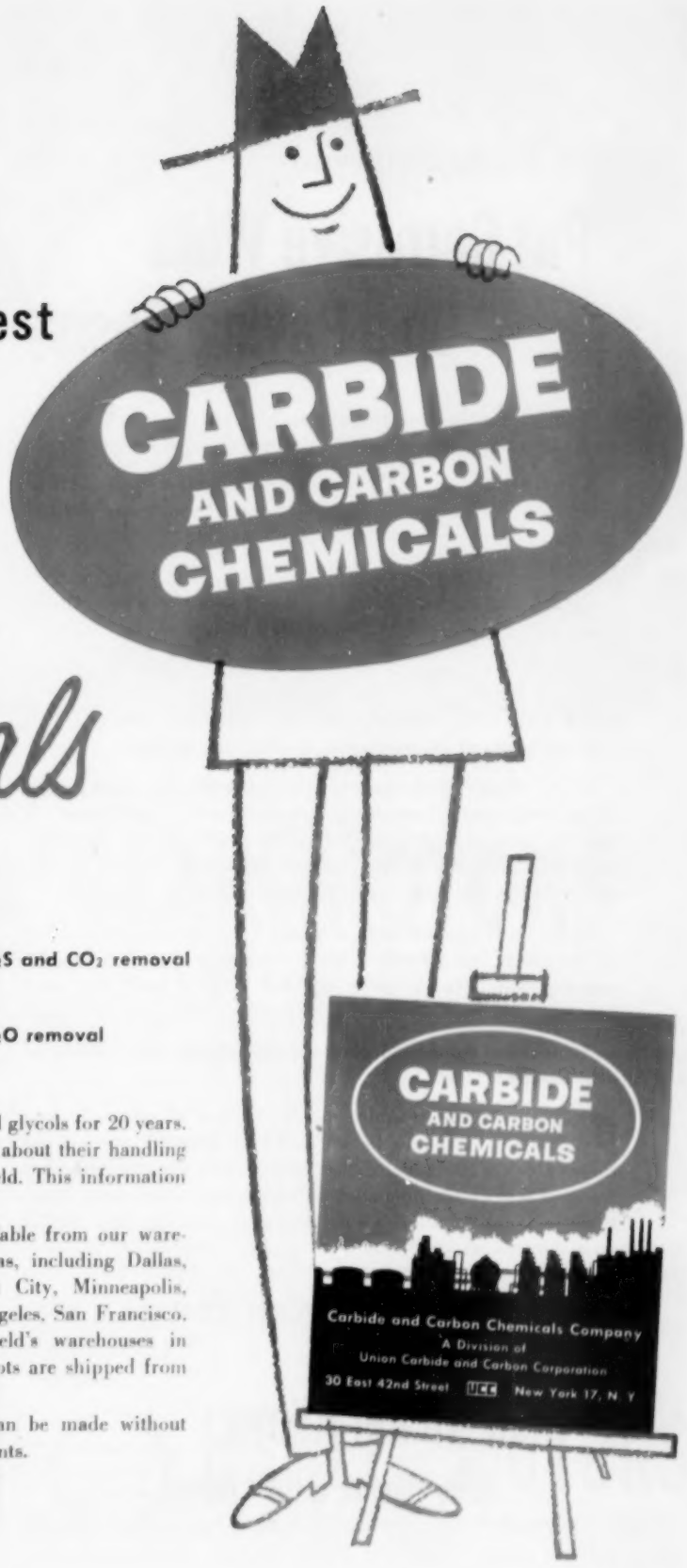
To be sure of the very best in valve performance, order W-K-M Valves for every purpose.

W-K-M Valves

W-K-M COMPANY

P. O. Box 2117, Houston 1, Texas
Los Angeles, California
Export Office: 30 Rockefeller Plaza, New York, N. Y.

The sign of the best in *gas treating chemicals*



MONOETHANOLAMINE
DIETHANOLAMINE 〉 For H_2S and CO_2 removal

DIETHYLENE GLYCOL
TRIETHYLENE GLYCOL 〉 For H_2O removal

• CARBIDE has been supplying amines and glycols for 20 years. During this time, we have learned much about their handling and use, especially in the gas-treating field. This information is yours by writing to our nearest office.

• These gas-treating chemicals are available from our warehouses in the major gas-producing areas, including Dallas, Houston, Tulsa, New Orleans, Kansas City, Minneapolis, Billings, Salt Lake City, Denver, Los Angeles, San Francisco. In Canada – from Harrisons & Crosfield's warehouses in Calgary, Edmonton, Vancouver. Drum lots are shipped from the warehouse or plant nearest you.

• Tank-car and tank-truck shipments can be made without delay directly from one of our several plants.

Let this pump help you

Put Corrosive Wells On a Paying Basis

With pumping equipment that fits your exact needs, even severely corrosive wells can be produced — *profitably.*

As an example of how important the right equipment is, consider the experience of an operator who was pumping 90 gallons a minute from a depth of 2,400 feet.

This was a satisfactory rate—as long as the pump worked properly. But it seldom did, for its efficiency was continually hampered by corrosion of pump shaft and diffusers.

The picture changed completely after the *Reda Pump Company,* of Bartlesville, Okla., stepped in. They equipped the pump with a "K"® Monel shaft and Ni-Resist® diffusers. And here, in terms of performance, is what this means:

A "K" Monel shaft, first of all, resists the corrosive action of gas and crudes containing hydrogen sulfide and brine. It has the extra strength needed to withstand heavy vibration, constant stress and sudden torque. Moreover, it resists wear, and the abrasive impact of entrained solids.

As for Ni-Resist diffusers, they not only minimize the effects of corrosion, but provide a more durable surface for rapidly turning impellers. A cable shielded with Monel® tape and securely held by Monel bands adds the final protective touch.

No wonder trouble in the well ended with installation of this pump!

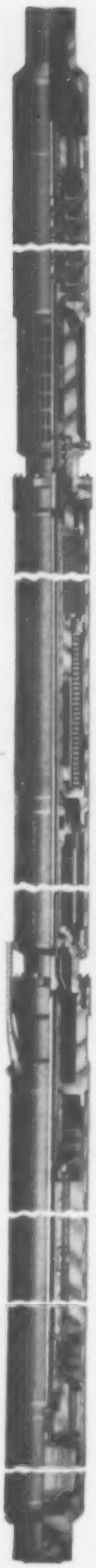
Other operating troubles, too, are often eliminated when Inco Nickel Alloys go to work. These metals have proved their value for use under difficult conditions. They've provided years of service for operators in highly corrosive areas. Keep them in mind, for there's a good chance they can solve one of your equipment problems.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

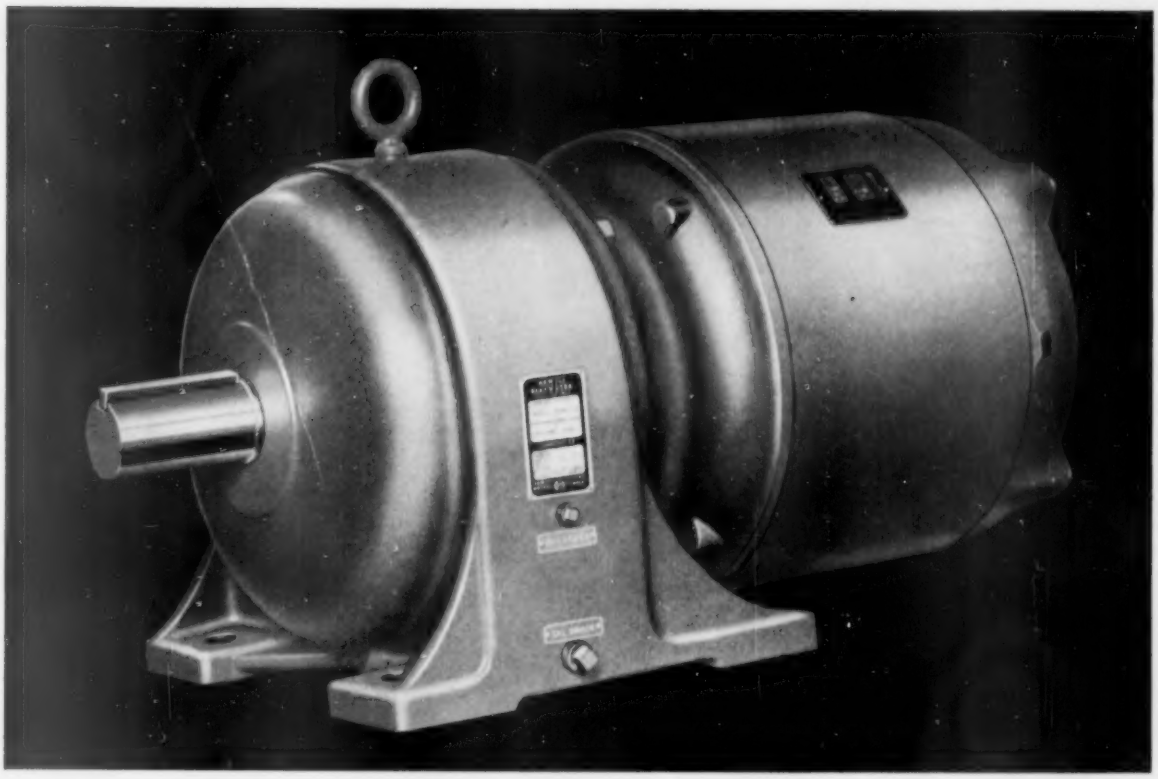
Inco Nickel Alloys

INCO **Monel & "K" Monel**

. . . YOUR PARTNERS IN PROGRESS

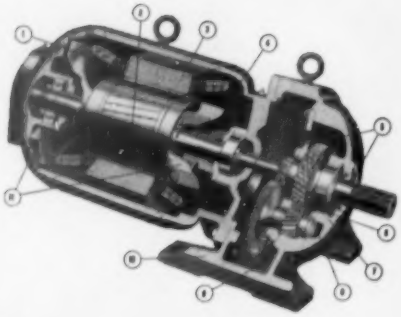


THE REDA PUMP has no gears, valves or reciprocating parts. The entire producing unit (including motor) is small enough to be run easily in wells cased with small diameter pipe. Capacities range from 20 to 13,000 barrels per day, with lifts up to 13,000 feet. For more information, write directly to the Reda Pump Company, Bartlesville, Okla., through whose courtesy the illustrations and operating data on this page were supplied.



The power you need at the speed you need it . . .

HOWELL GEAR MOTORS



11 reasons why Howell Gear Motors last longer, serve you better

1. High-quality insulation
2. Copper-clad rotor
3. Expert craftsmanship
4. High-quality coil varnish
5. Leakproof oil seals
6. Duti-Rated Lifetime Gearing
7. Unit case construction with integral bearing housings
8. Corner-mounted offset shaft
9. Large oil reservoir
10. Heavy, cast-iron construction
11. Superior cooling

New dependability, greater starting torque and top efficiency, with output speeds as low as 7.5 rpm. are now available in Howell Gear Motors.

This compact, single-unit motor may well be the answer to your gear reduction problems. Combining the finest in heavy duty industrial gearing with the best in motoring, Howell Gear Motors reduce drive failures and production downtime.

Howell Gear Motors use duti-rated, lifetime gearing, with file-hard tooth surfaces and tough, resilient cores. They are available in all types of enclosures, from 7.5 to 780 rpm. with a capacity range from 1 to 30 hp., in all three AGMA service classifications.

For full information on Howell Gear Motors, contact the Howell man in your area, or write the factory direct for Bulletin GM-1.

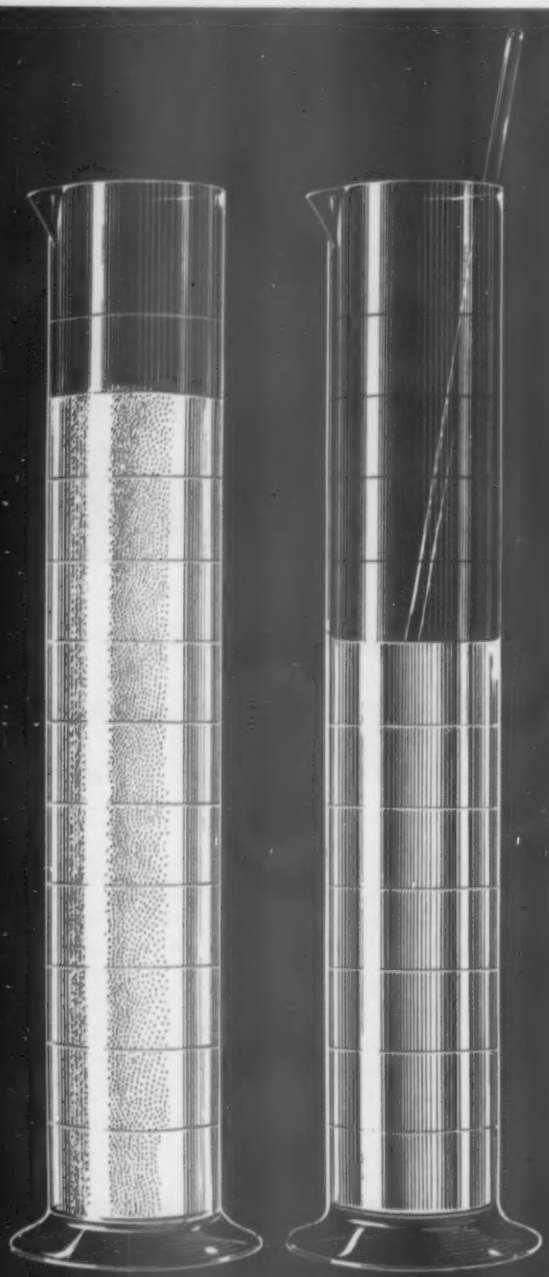
HOWELL Red Band MOTORS

HOWELL MOTORS

HOWELL ELECTRIC MOTORS COMPANY, HOWELL, MICHIGAN

MOTORS FOR INDUSTRY SINCE 1915

YOU CAN "SHRINK" SODA ASH TO SAVE SPACE...CUT COSTS



In many of the chemical process industries, wet storage of soda ash provides a means of reducing storage space and increasing handling efficiency. In slurry form, soda ash occupies 30% less space than an equal weight of the dry material. Conversely, it is possible to store over 40% more soda ash as a slurry in the same volume now required for dry storage. In addition, the wet systems permit greater ease of handling and substantial savings in installation and processing costs.

A number of manufacturers using soda ash in their operations are taking advantage of the cost reductions realized through slurry storage. In many cases, helpful information and assistance has been provided by Mathieson—one of the pioneers in the development of wet soda ash storage systems. Mathieson's technical service staff, with years of practical experience in the handling and use of soda ash, is available for consultation with your engineering department. A call to your Mathieson representative is all that's needed.

MATHIESON

MATHIESON CHEMICAL CORPORATION
Mathieson Industrial Chemicals Division
Baltimore 3, Maryland

caustic soda · soda ash · chlorine
sulphur · sulphuric acid · bicarbonate of soda · ammonia · sodium nitrate · nitric acid · hydrazine products · sodium methylate · sodium chlorite · hypochlorite products
dry ice and carbonic gas · ethylene glycols and oxide · methanol

2084

Why this special oil field jack will give longer trouble-free service

the Roustabout "1523"

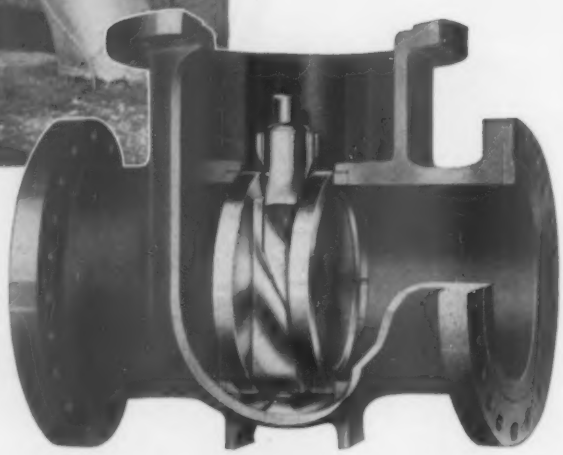
When Duff-Norton engineers set out to design safer, longer-lasting jacks for men who work in the oil fields, they discovered one startling fact—about 90% of jack maintenance was in replacing worn springs in the mechanism that controls the jack's raising or lowering action. Result? The Duff-Norton Roustabout "1523" oil field jack is equipped with a patented*, adjustable spring mechanism which assures positive engagement of rack teeth. The spring's tension can be easily adjusted with a screw driver without removing any part of the jack. Should the spring eventually lose its resiliency, there's no need to send the jack to a repair shop. A new, complete spring mechanism assembly can be quickly installed by anyone in a matter of minutes right in the field, making the jack as good as new!

Complete with detachable steel chain, this versatile jack can be operated at any angle at its full 15-ton capacity. Ask your supply store salesman for the Duff-Norton Roustabout "1523." He has it in stock or can get it for you quickly. For complete specifications on this and other dependable Duff-Norton jacks, write the world's oldest and largest manufacturers of lifting jacks for special Oil Field Jack Bulletin AD19B, The Duff-Norton Manufacturing Co., P. O. Box 1889, Pittsburgh 30, Pa. Canadian Plant—Toronto 6, Ontario.

"Giving Industry A Lift Since 1883"

DUFF-NORTON Jacks

Darling 20" fully revolving double disc, parallel seat cast steel gate valves, with manually and motor-operated bevel gear, installed on a major line.



Darling cast steel pipe line gate valves

Rated tops at keeping out of trouble!

IT won't cost you a cent to find out *why* you stand to save plenty with Darling pipe line gate valves on the job. Aside from extra rugged, stress-proved construction throughout, it's Darling's unique fully revolving double disc, parallel seat principle that *really* pays off!

Take a close look at the cutaway view. The rugged, self-adjusting wedges *automatically* seat the fully revolving, no-pocket discs, assuring tight, easy closure. Coupled with uniform wear distribution, these valves do a better job and last longer with less attention, less maintenance.

If it's proof of performance you're after, check with some of Darling's pipe line users. Meanwhile, you are welcome to a descriptive bulletin giving *all* the money-saving facts. Darling gate valves are available in all pressures and various constructions for main line, gathering, manifold, tank farm and all other services.

for plus values job-proved again and again

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

WHY IT PAYS TO BUY STAINLESS BARS FROM US

TRIPLE SECURITY

What you want
When you want it
At the right price

ONE of our experienced stainless men will be glad to work with you on stainless steel selection problems so that you can use the most effective and economical grades and sizes. And we follow through from design to delivery to make sure that you get exactly the steel specified for the job. With complete stocks of dependable USS Stainless Steels, fast delivery service, and competent, thorough technical assistance, we offer a real cost-cutting combination.

Whatever your demands, it'll pay you to call on U. S. Steel Supply the next time you need stainless steel. Our unusually complete stocks of USS Stainless include bars—rounds, squares, hexagons, angles, channels, and the widest selection of grades, sizes and finishes of sheets and strip available.

For further information on stainless steel, just send us the coupon.

U. S. STEEL SUPPLY

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Chicago 4, Ill.

Gentlemen:

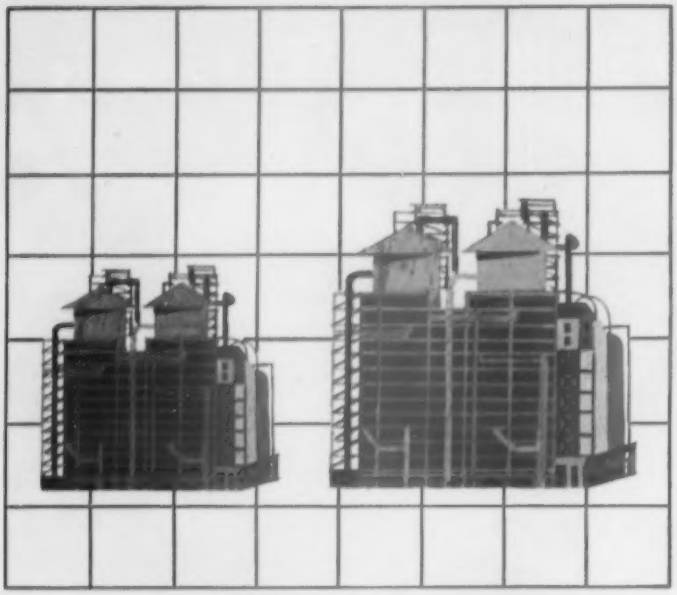
Please send me, without obligation, your literature containing complete information on your Stainless Steel stocks and service.

Name .....

Company .....

Address .....

City ..... State .....



CHEMICAL PROGRESS WEEK-MAY 1957

If you want a 14.6% increase in throughput, switch to

AEROCAT®

MS SYNTHETIC CRACKING CATALYST

Recent studies of operations in 55 fluid cat crackers show that where regenerating capacity is a limiting factor, use of AEROCAT MS Synthetic Cracking Catalyst can increase throughput 14.6% over natural catalyst.

Here's why. In burning coke off the catalyst, two variables are involved: the ratio of carbon to hydrogen in the coke, and the ratio of CO_2 to CO in the flue gas. More oxygen is needed to burn off hydrogen than carbon, and more to burn carbon to CO_2 than to CO.

The studies showed that coke carried by natural catalyst is 13% hydrogen; by synthetic, only 9.5%. The CO_2/CO ratio of flue gas with natural is 2.05; with synthetic, only 1.55.

Consequently, AEROCAT requires 12.8% less oxygen for regeneration. Thus, if a refiner is operating at maximum air capacity, a 14.6% increase in throughput is made possible by a switch to AEROCAT.

Among all fluid cat crackers now using synthetic, 8 out of 10 use AEROCAT—because it is the surest, most economical means to

- high octane
- low CO_2/CO ratio in flue gas
- high isobutane yield
- excellent heat, steam, sulfur stability.

If you want increased throughput, plus the many other advantages of AEROCAT, write or call Cyanamid's Technical Service Representative. Cyanamid has the research facilities, the staff and the experience to solve individual application problems and can be relied upon as a source of supply.

AMERICAN Cyanamid COMPANY

REFINERY CHEMICALS DEPARTMENT

30 Rockefeller Plaza, New York 20, New York

In Canada: North American Cyanamid Limited, Toronto and Montreal

MICHIGAN *bucket control means "Bigger Loads . . . . . FASTER"*

Watch a MICHIGAN Tractor Shovel at work —with particular attention to bucket action —and you'll *see* how a MICHIGAN* will *handle bigger loads, move more yardage*—faster, at considerably lower cost.

- *Tremendous break-out power*—ram the cutting edge into any tough, hard-to-dig clay, shale or loose rock—and *work the bucket* to loosen it
- *Bucket roll-back at ground level*—pick up and transport full buckets at low center of gravity for safe traveling, no void space in the bucket; more work in less time
- *Remarkable digging ability*—two large double acting cylinders on bucket and two large double acting cylinders on main lift give excellent control and superior digging action.
- *Good bucket height and reach*—high dumping clearance and ample forward reach make trucks easy to load.

Check these outstanding* Quality Features of MICHIGAN* Tractor Shovels . . .

1. **Superior Bucket Action**—bigger loads, faster loading
2. **Clark Power-Shift Transmission**—faster operating cycle gets more yardage
3. **Clark Torque Converter**—3-to-1 torque multiplication; power when needed—no conventional clutch
4. **Clark Planetary Axle**—relieves torque load on shafts and gears, prolongs machine life
5. **Power Steering**—much easier handling, lessens driver fatigue
6. **Gas or Diesel**—right power for the job; more horsepower than any comparable machine

Six models: capacities from 15 cubic feet to 2¼ cubic yards. Facts about the MICHIGAN Tractor Shovel are important—and interesting. The MICHIGAN Fact Folio contains specifications and action photos. The coupon gets it for you.

*A Trademark of Clark Equipment Company

CLARK EQUIPMENT

16

CLARK EQUIPMENT COMPANY
Construction Machinery Division
448 Second Street, Benton Harbor, Michigan

Please send the MICHIGAN Tractor Shovel Fact Folio

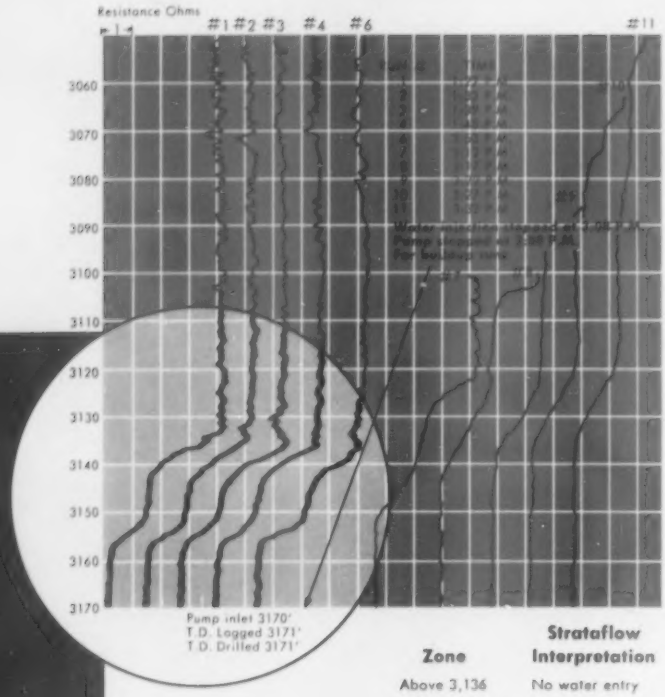
Name_____ Title_____

Firm_____

Address_____

City_____ County_____ State_____

STRATAFLOW LOGS WATER ENTRY ZONES DURING *NORMAL* PRODUCTION



Zone	Strataflow Interpretation
Above 3,136	No water entry
3,136 – 3,141	Water entry
3,141 – 3,153	Minor entry
3,153 – 3,157	Major water entry
3,157 – TD	No entry

A survey while the well is in normal production—that's the key to more accurate location of major and minor zones of water entry. Only with Strataflow is this record made while the well is producing under conditions almost identical to normal—even in wells with a low or moderate productivity index.

Each formation, whether water or oil producing, flows normally before and during the full test period. Except for a brief shutdown for water consolidation, the well is produced continuously and is never likely to approach static equilibrium. That also provides maximum protection against flooding low pressure formations with foreign fluids.

Halliburton's Strataflow equipment measures the resistivity between a conditioning fluid, usually fresh water, that is placed in the well bore and the salty formation water. As formation fluids enter the well bore and dilute the fresh water, a special 1" electrode measures the resistivity difference and provides a foot by foot record. Water zones are clearly indicated on the continuous log.

Developed as the logical first step for successful workover, Strataflow is now being used with equal success in locating vital water *departure* points in water flooding programs. For either purpose, Strataflow has been proved the one dependable, economical and widely applicable method of revealing water flow in pumping wells. Strataflow data, taken during *normal* production, gives you an accurate record of water zones in your well. Phone your local or district Halliburton office. Or contact Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

HALLIBURTON

ELECTRICAL WELL SERVICES

Strataflow—Reg. U. S. Pat. Off.

PERPETUAL PROGRESS IN PRODUCTION IMPROVEMENT TECHNIQUES

...it stands alone–

In this latest development we reaffirm our pledge to make a better gauge ever better. Only in the Marsh Christmas Tree Gauge you have:

—**A better tube construction**— bourdon tube and socket fused into a one piece permanently leak-proof unit by the exclusive Marsh "Conoweld" process.

—**A better movement**—all but frictionless as a result of the self-lubricating effect of unlike metals. Coined sector gear gives greater strength where greater strength is needed; also smoother operation.

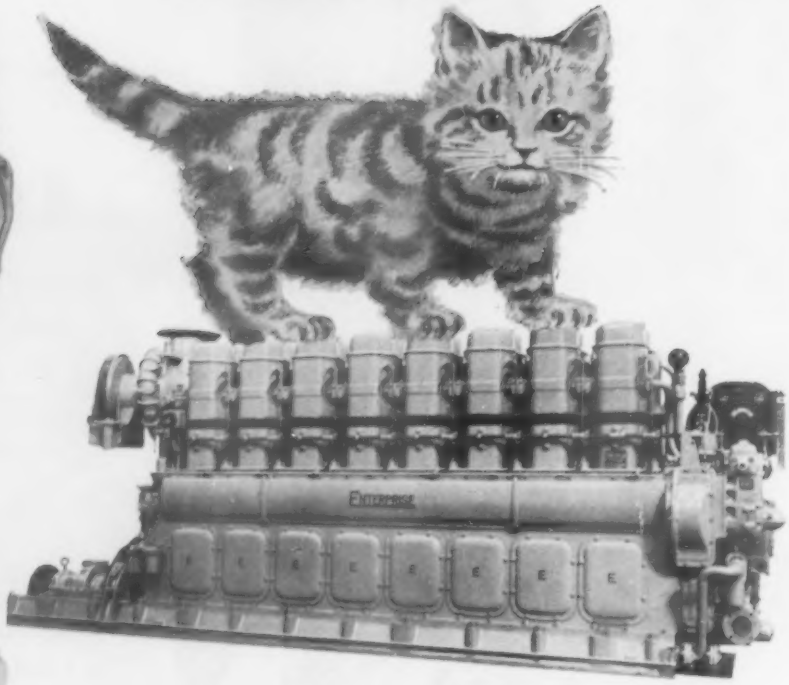
—**A better case**—a copper-clad wrought steel case of boiler plate thickness, produced by the "Marsh-alloy" process. It has the strength of steel, the corrosion resistance of copper, and is one-third lighter than conventional cast-rion cases. The case is finished in corrosion-resistant satin black enamel.

—**the Marsh "Recalibrator"**—not only the handiest way to keep a guage accurate; also the *best* way.

★ There is a Marsh Gauge for every oil country and refinery application. Ask your supply house or write for latest bulletins.

MARSH INSTRUMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
DEPT. L., SKOKIE, ILL.
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas

QUIET
as a kitten



ENTERPRISE has cut "Noise Level" to a minimum —all parts hum smoothly, wear longer

Enterprise has gone far in taking the head-splitting noise and damaging vibration out of diesel operation. From base to manifolds, ENTERPRISE Diesels are carefully engineered and constructed to overcome harmful vibrational effects and noise – without sacrificing any of the famous ENTERPRISE high performance features. By all comparison, the resulting smooth operation is "quiet as a kitten." A low noise and vibrational level means less wear, lower maintenance cost, higher overall efficiency and economy.

This is but another of the many plus values enjoyed by ENTERPRISE customers the world over. Get all the facts... and your choice, too, will be ENTERPRISE.

Write for descriptive bulletins, or call your nearest ENTERPRISE *Diesel Sales office.*

Check these points on
Enterprise Quiet-Running Diesels
Complete precision surface finishing of all moving parts to close tolerances permits accurate control of weights and balances, helps keep noise and wear to a minimum.
Conservative speed ratings result in major reduction of noise.
Carefully engineered injection system minimizes "injection knock."
Base, block, gear case and cylinder heads are of heavy-sectioned cast iron, providing a maximum damping of internal noise.
Water jacketed manifolds absorb exhaust noises.
Modern design decreases flat external surfaces which act as sounding boards.
There is nothing finer in Heavy-Duty Diesels!

Enterprise
DEPENDABLE
Diesels

ENTERPRISE ENGINE & MACHINERY CO.
18th & Florida Streets, San Francisco 10, California
A SUBSIDIARY OF GENERAL METALS CORPORATION
Boston · Chicago · Denver · Kansas City · Los Angeles
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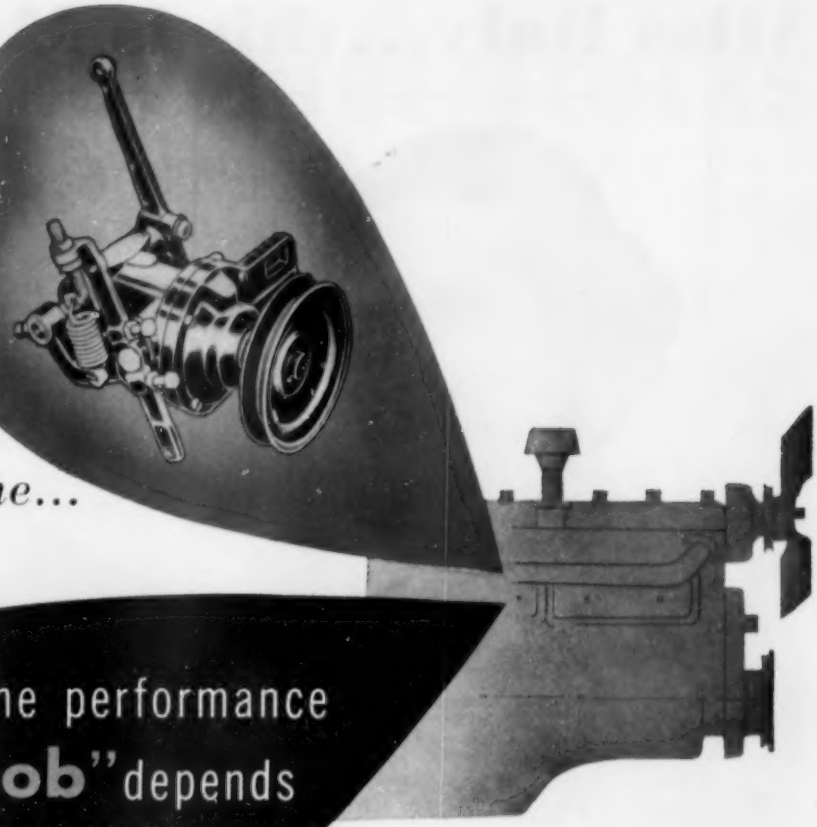
San Francisco · Seattle · St. Louis · Washington, D. C.
DIESEL ENGINES • OIL BURNERS • PROCESS MACHINERY

the heart of your engine...



engine performance "**on the job**" depends on its GOVERNOR

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are your most economical and efficient control mechanisms for industrial engines . . . from small generator sets to monster power units . . . gas (LPG), gasoline or diesel. Service is locally available . . . your nearby Pierce Service Station is equipped for all types of Pierce Governors.

Specify PIERCE Centrifugal governors on your engines . . . for economical, thoroughly dependable control in industrial applications.

"WORLD'S MOST EXPERIENCED GOVERNOR MANUFACTURER"

the PIERCE GOVERNOR COMPANY
INCORPORATED
1620 OHIO AVENUE
ANDERSON, INDIANA

PIERCE — THE MARK OF QUALITY

Miss Daly...this is Mr. Zehner

STOCKHOLDER-OWNERS like Miss Daly know that about two-thirds of our profits have been plowed back in recent years for new facilities and equipment—from drilling rigs to delivery trucks. This increases the intrinsic worth of their investment, and helps make possible better service and better products for you and millions of other Standard Oil customers.

MR. ZEHNER, an accounting clerk, is one of more than 50,000 employees of Standard Oil and its subsidiary companies. He has been with Standard Oil for more than seven years and is backed by one of the finest employee benefit programs in any industry. He and about 25,000 other employees own company stock. Mr. Zehner and his wife live in Whiting, Indiana.

MISS DALY AND MR. ZEHNER are members of the same business family, but they have never met.

Miss Grace Daly is a student at Mount St. Scholastica College, Atchison, Kansas. Mr. Carl E. Zehner works at the Standard Oil refinery in Whiting, Indiana. Both own stock in the Standard Oil Company.

Standard Oil's stockholder family is so large—it has almost 118,000 members—and is spread over so much territory and embraces people in so many walks of life that it would be impossible for one stockholder to know all the others. Our stockholder family also includes many institutions such as colleges, hospitals, charitable organizations and insurance companies.

And, incidentally, the largest amount of our stock any one person owns is less than 1% of the total, and the largest amount any institution owns is less than 4%.

Last year the investments of our stockholder-owners helped provide more than 50,000 jobs, more than $300 million in employee wages, salaries and benefits, and more than 2,000 useful petroleum products at reasonable prices.

These share-owners in American business have confidence in a steady return on their investment. Standard Oil has paid dividends for 61 consecutive years. Last year dividends had a value equal to $3.86 per share—the return to our stockholders for the use of their savings.

Standard Oil Company
(INDIANA)

MEET ANOTHER stockholder—Mrs. James C. Graves, a widow, of Saginaw, Michigan. Dividends from Standard Oil stock help to make life more comfortable for many persons who depend on investments for income. Incidentally, more than half of our individual stockholders are women.

MEET ANOTHER stockholder—Children's Mercy Hospital, Kansas City, Missouri. Its Standard Oil dividends are used to help care for about 3,500 children a year, three of whom are shown here with nurse Dolores G. Turnage. Many such institutions depend on dividends to help defray expenses.

MEET ANOTHER stockholder—dealer J. E. Gossett, an independent businessman of Richmond, Indiana, servicing the car of Earl Whitten, a long-time customer. Mr. Gossett, a dealer for more than 11 years, has seen the demand for Standard Oil products increase steadily over the years.

New Chevrolet Trucks

are powered and priced to save you plenty!

When it comes to saving money, you just can't beat a new Chevrolet truck. Here are two good reasons why this is true—

YOU SAVE AT THE START

In fact, your savings start the moment you close the deal for your new Chevrolet truck. That's because Chevrolet is America's lowest-priced line of trucks. And yet, no other truck at *any* price offers you all the new features and advantages you get in these great new Chevrolet trucks.

YOU KEEP RIGHT ON SAVING

You save on operating costs with thrifty new high-compression power . . . on upkeep costs with new chassis ruggedness. And you get these savings with every new Chevrolet truck—from light delivery models to heavy-duty haulers. In addition, Chevrolet trucks traditionally put you dollars ahead at trade-in time.

Aren't these the kind of savings you want in a truck? Stop in and talk it over with your Chevrolet Dealer soon. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

MOST TRUSTWORTHY TRUCKS ON ANY JOB!

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

THREE GREAT ENGINES—The new "Jobmaster 261" engine* for extra heavy hauling. The "Thriftmaster 235" or "Loadmaster 235" for light-, medium- and heavy-duty hauling. **NEW TRUCK HYDRA-MATIC TRANSMISSION***—offered on ½-, ¾- and 1-ton models. Heavy-Duty **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **DIAPHRAGM SPRING CLUTCH**—improved-action engagement. **HYPOID REAR AXLE**—for longer life on all models. **TORQUE-ACTION BRAKES**—on all wheels on light- and medium-duty models. **TWIN-ACTION REAR WHEEL BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—greater holding ability on heavy-duty models. **NEW RIDE CONTROL SEAT***—eliminates backrubbing. **NEW, LARGER UNIT-DESIGNED PICKUP AND PLATFORM STAKE BODIES**—give increased load space. **COMFORTMASTER CAB**—offers greater comfort, convenience and safety. **PANORAMIC WINDSHIELD**—for increased driver vision. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—easier, safer handling. **ADVANCE-DESIGN STYLING**—rugged, handsome appearance.

**Optional at extra cost. Ride Control Seat is available in standard cabs only. "Jobmaster 261" engine on 2-ton models, truck Hydra-Matic transmission on ½-, ¾- and 1-ton models.*

1 With an ordinary hand saw, cut the pipe to whatever length you need, right on the spot.

2 Clean the outside of the pipe and the inside of the plastic fitting. Fittings are available from Republic.

3 Using a standard paint brush, coat the inside of the fittings and the outside of the pipe with thinner.

4 Use same brush to apply welding solution to male end of pipe. Apply solution to within ¼" but not closer than ⅛" from end of pipe. This prevents internal bead from forming.

5 Stab pipe in fitting, give one-eighth turn, and the job is finished. This method of joining speeds new lines as well as replacements.

HOW TO INSTALL OIL PIPE LINES

...THE NEW EASY WAY

Your next oil field pipe line installation will be unusually easy if you use Republic Semi-Rigid Plastic Pipe. One reason: it's lightweight—3" pipe weighs only 13 lbs. per 20-foot length. Truck loading and unloading are simplified. Field assembly is speeded up. One man can easily carry several lengths at once. Even ditch a whole string by himself.

Joints are easy to weld, too, right on the spot. Tools? Ordinary hand saw and paint brush. Just follow the five simple steps illustrated at the left. When connection to steel pipe is necessary, a special flange adapter is provided.

Another big advantage: Republic Semi-Rigid Plastic Pipe, made of butyrate, is highly resistant to corrosive elements in petroleum products. Its smooth walls resist paraffin-clogging. This means long life, minimum maintenance.

Semi-Rigid comes in 20- and 40-foot straight lengths, in 9 sizes from ½" through 6". In coils, ½", ¾" and 1" diameters are available. It is normally supplied in black. Clear pipe is available on request. Remember: Republic Semi-Rigid Plastic Pipe is made by pipe men—men who know your piping problems. For complete information, send for Booklet No. 603.

NEW FREE BOOKLET No. 603 gives sizes, lengths, test pressures and other valuable information on Republic's New Semi-Rigid and Flexible Plastic Pipe. Write for it.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC STEEL
REPUBLIC PLASTIC PIPE
SEMI-RIGID AND FLEXIBLE

Other Republic Products include Casing — Tubing — Line Pipe — Bolts, Studs, Nuts and Rivets — Heat Exchanger Tubes — Steel Buildings

FIRE!

PUT IT OUT IN SECONDS

with a Kidde Portable extinguisher

Unless you get the jump on fire the minute it starts, you stand a good chance of kissing your business good-bye.

That's why it's so important to have a Kidde portable extinguisher near *every* fire hazard in your plant.

Protect motors, electrical equipment, flammable liquids and machinery with Kidde portables. Then, when fire strikes, you're ready for it.

Just grab a Kidde CO_2 or dry chemical portable, aim the horn, pull the trigger, and—Whoosh! No more fire!

Your *next* fire could be your *last* . . . Contact Kidde today!

Kidde

The words 'Kidde', 'Lux', 'Lux-O-Matic', 'Fyre-Foez' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc.
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Walter Kidde & Company of Canada, Ltd., Montreal—Toronto

ENDURANCE...

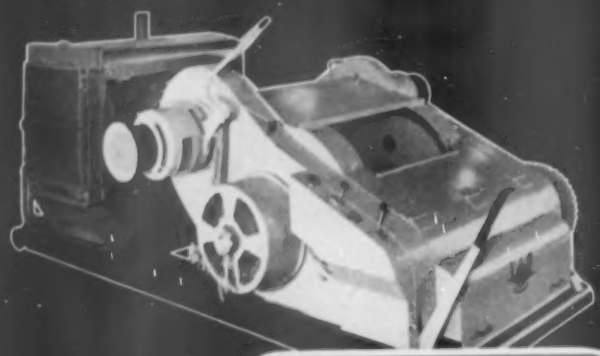
1,000,000 feet of hole has been drilled by the first UNIT U-34 . . . and it's STILL drilling.

ENDURANCE is built into this little rig with big rig performance with . . .

- . . . hydraulic torque converter providing wide range of speed, maximum obtainable horsepower, smooth operation and elimination of shock loads.
- . . . one lever clutch and throttle control promoting fast, safe operation.
- . . . built in hydromatic brake with automatic declutching arrangement.
- . . . skid or trailer mounted for ease of handling and transporting.
- . . . minimum of upkeep required. Few adjustments are ever necessary.

The UNIT U-34, with ENDURANCE built in, is designed for economical drilling from 1,500 to 4,500 feet.

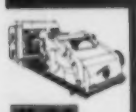
Buy a Rig with ENDURANCE . . . Buy a UNIT U-34.



U-34

UNIT RIG & EQUIPMENT CO. TULSA, OKLAHOMA U.S.A.

DESIGNED FOR THE JOB....



UNIT RIG DRAW WORKS ARE SOLD THROUGH THESE DISTRIBUTORS IN THE U.S.A. AND CANADA

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Iverson Supply Company
Mid-Continent Supply Company
Houston Oil Field Material Company
Norvell-Wilder Supply Company
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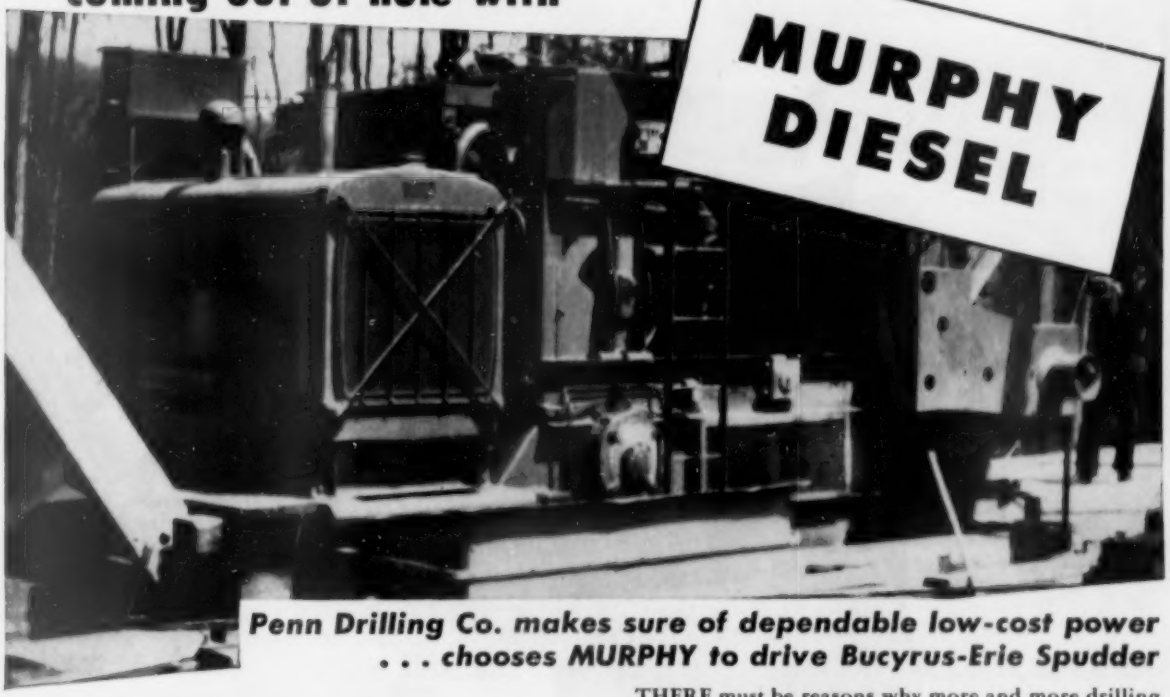
Lucey Products Corporation
And Other Leading Supply Houses

Export Sales—Mid-Continent Supply Company, 42 Broadway, New York City. Cable—Midunitrig

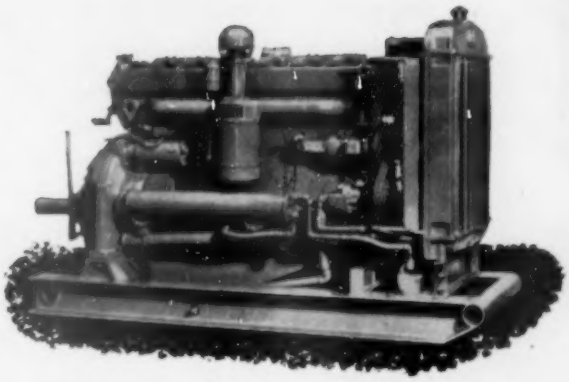
Plenty of Lugging Power

coming out of hole with

MURPHY DIESEL



Penn Drilling Co. makes sure of dependable low-cost power . . . chooses MURPHY to drive Bucyrus-Erie Spudder



Murphy Diesel engines and power units are made in sizes from 90 to 260 H.P.; dual-fuel engines, 135 to 215 H.P.; generator sets from 60 to 154 K.W.

THERE must be reasons why more and more drilling contractors pick Murphy for power in the oil field. Here are some of them. *Quick starting*: A Murphy kicks off fast and easy . . . even in subzero temperatures. This is assured by precise fuel control by the Murphy Unit Injector and "true" diesel principle. *Good, reliable lugging power* results from high torque that rises fast as engine speed is dragged down. This is the kind of torque you can get with Murphy Diesel. *Low operating costs*: less fuel is burned because of the Murphy Unit Injector system and "true" diesel efficiency. Minimum maintenance and longer life result from distortionless pistons, four valves per cylinder, hydraulic-servo type governor and many other advanced design features. Add them up. You'll find that Murphy gives you more heavy duty power at lower cost than any other engine of comparable size. To get a more detailed picture ask your Murphy dealer for a copy of "10 Reasons Why Your Next Engine Should Be a Murphy" or write direct today.

MURPHY DIESEL COMPANY
5305 W. Burnham St., Milwaukee 14, Wisconsin
FACTORY BRANCH: Sales, Parts and Service—113-116 S. Elwood St. Tulsa, Oklahoma

280

MURPHY DIESEL

SEE YOUR MURPHY DIESEL DEALER, TODAY—

ALBUQUERQUE, NEW MEXICO, Lively Equipment Company; BUTTE, MONTANA, Hall-Perry Machinery Company; CORPUS CHRISTI, TEXAS, Houston Engine & Pump Company; DALLAS, TEXAS, Conley-Lott-Nichols Machinery Co.; DENVER, COLORADO, Power Equipment Company; EDMONTON, ALBERTA, CANADA, Northern Engine & Equipment Co., Ltd.; GREAT BEND, KANSAS, Manufacturers Dist. Co.; GREAT FALLS, MONTANA, Hall-Perry Machinery Company; HOUSTON, TEXAS, Houston Engine & Pump Co., Inc.; JACKSON, MICHIGAN, Utility & Industrial Supply Co.; LOS ANGELES, CALIFORNIA, Industrial Engine Service; LUBBOCK, TEXAS, Conley-Lott-Nichols Machinery Co.; SAN ANTONIO, TEXAS, J. E. Ingram Equipment Co.; BAKERSFIELD, CALIFORNIA, Glenn Rose Engine Service; ODESSA, TEXAS, Conley-Lott-Nichols Machinery Co.; LONGVIEW, TEXAS, Nichols Machinery Co.

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Bring cuttings up FAST... by reverse circulation

with GUIBERSON

Type J ROTATING DRILLING HEAD

SLIPS, TABLE AND KELLY BUSHING
OIL RESISTANT PACKING RUBBER
POWER TAKE OFF
FULL FLOATING WASHPIPE
UNION OR FLANGE TYPE BOTTOM

Virtually a small rotary table, for work-overs, clean-out work, slim-hole drilling, or drilling in with controlled pressure, the Guiberson Type J Head offers you many exclusive features. It will drill cement plugs, float collars and new hole at an exceptionally fast rate.

BOTTOM CONNECTION	CASING SIZE
Union, Minor Hub with Two 2" Side Outlets	5½" 7"
Union, Standard Minor Hub	8⅝"
Flange, 6" — 600 6" — 900 Series	6"-7"

THE
GUIBERSON
CORPORATION

ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.

Sold By Leading Oil Field Supply Stores Everywhere

They Say—

Looking Into the Future

"Looking ahead, it is our view that demand for the oil industry's products this year will average 4 to 5 per cent over 1953. . . .

". . . We estimate that the consumption of gasoline in the United States in the next 5 years will be about 21 per cent higher than it was in 1953, and that the demand for all petroleum products will be at least 23 per cent higher.

"Looking even further ahead, we believe that in 1975 The Texas Co. will be supplying petroleum products to a nation of around 200 million people, with a total production of goods and services (gross national product) of 575 billion dollars. . . .

"In line with this favorable long-term outlook, we have under consideration a 5-year expenditure program of more than a billion dollars for the expansion of our crude reserves and for new plant and equipment. . . ."

Augustus C. Long, president of The Texas Co., addressing a stockholders meeting.

Setting You "Straight"

Sir:

This office is beginning to receive letters concerning an article on uranium leasing which appeared in The Oil and Gas Journal of February 8, 1954, on page 66 and entitled "Uranium Lease Rules—AEC Can Issue Permit for Mining on Oil-Lease Land."

This article points out that an act of Congress created valid claims on areas staked between July 31, 1939, and January 1, 1953, and that the act (Public Law 250) has no provisions for uranium leasing on oil and gas lands after January 1953. The next phrase in the article says: "But AEC officials say these later discoveries can be exploited by leases secured from the holder of the oil and gas lease, subject to government confirmation." This portion is entirely erroneous and is misleading to readers of your publication who may be interested in the subject.

Uranium mining leases on these oil and gas lands are secured directly from the U. S. Atomic Energy Commission through the Grand Junction Operations Office under the terms of Domestic Uranium Program Circular 7. Some of these terms are quoted correctly in the last three paragraphs of your article.

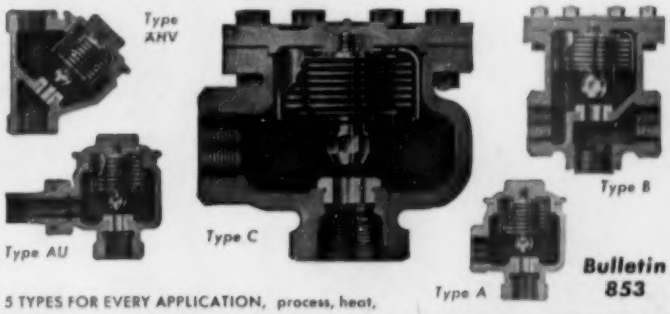
Any oil and gas leases that may exist

In This Plant Nicholson Traps

SAVED 10% IN STEAM COSTS

Chief Engineer H.F.D. stated, after Nicholsons replaced mechanical traps in his plant: "Saving in steam waste cut our fuel cost at least 10%. Yet application temperatures were up 30°-40°. And relief of all air binding effected faster warm-up."

Operate on lowest temperature differential; 2 to 6 times average drainage capacity; maximum air venting. For other advanced Nicholson features send for Bulletin 853.



5 TYPES FOR EVERY APPLICATION, process, heat, power. Sizes ¼" to 2"; pressures to 250 lbs.

Bulletin 853

210 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

for a cool, comfortable office

EMERSON-ELECTRIC

ROOM AIR CONDITIONERS

You'll be cool and comfortable this summer with the finest air conditioning available when you depend on EMERSON-ELECTRIC room air conditioners. Compare them with any on the market and you'll find they have the same quality of design and construction that has made EMERSON-ELECTRIC the leader in the fan field for years.

PHONE 5-1241 TULSA

When it's Electrical

NELSON

ELECTRIC SUPPLY CO.

526 North Main • TULSA

Where Mission makes the difference

In the manufacture of Mission Super-Service Liners, there are scores of exacting operations that only Mission does which make the difference in performance you get in the field. For example, this huge induction hardening machine . . . the only one of its capacity and especially made for Mission . . . produces a deep, file-hard case which eliminates soft spots and prevents uneven liner wear. Finally, Mission applies the exclusive Satin Finish process . . . another "little thing" that no other liner manufacturer has ever done . . . as a further guarantee of longer service for your pistons and liners. Specify Mission Super-Service Liners to your supply store. Be assured that the difference Mission makes in its manufacturing, makes a difference in the performance and service you get in the field.

Nothing but the finest will ever bear the name of

MISSION
MANUFACTURING CO.

P. O. BOX 4209 • HOUSTON, TEXAS

Export Office: 30 Rockefeller Plaza, New York

Republic Aviation operates P&H high-frequency welders as standard metallic arc welders, also, so that duplicate equipment does not have to be purchased.

More than doubles welding speed with P&H

30 P&H TH-200 high-frequency machines make inert gas arc welding 2½ to 3 times faster than former gas welding at Republic Aviation Corporation

No replacement maintenance in three and a half years of two-shift operation

You don't have to take our word for the outstanding performance record of P&H Welders. The following statements are actual quotes from a certified report issued by the H. P. Gould Co. of Chicago, who made an impartial study of welding operations at Republic Aviation Corporation, Farmingdale, L. I., N. Y.

"In the building of faster and better aircraft, new developments in welding have played an important part and P&H high-frequency inert gas welding has proved that it can solve the problems of welding aluminum alloys.

"Three and a half years ago, Republic Aviation tested P&H TH-200 HF Inert Gas AC Arc Welders, and evaluated them against the existing equipment in the plant, as well as against outside competition.

"P&H welders of four different types are now used in four locations in the plant, for the welding of hundreds of different parts. In general, they are welding aluminum alloys from .032" thickness up to .250", and heat-resisting alloys from .010" up to a thickness of .093". For arc-welding alloy steels (4130, 4140, 8630, 8740, etc.), experience has proved P&H electrode AW-4 most satisfactory, and it is used exclusively.

"Republic Aviation welding engineers back up the claim of the makers that P&H welders require very little maintenance. The 30 high-frequency arc welders have had no replacement maintenance whatever in three and a half years of two-shift operation — and the operating cost of each P&H TH-200 HF Welder is only 40¢ per day."

Like Republic Aviation, whose studies show P&H inert gas arc welding to be 2½ to 3 times as fast as former gas welding you, too, can enjoy the money-saving advantages of P&H Arc Welders with Dial-lectric Control. You, too, can get faster, better welds at lower cost.

We've given you the Republic Aviation story in a nutshell! You can get all the detailed facts and figures by reading Gould Report No. 5311. Write for your copy today.

P&H WELDING DIVISION

HARNISCHFEGER CORPORATION

4527 WEST NATIONAL AVE. • MILWAUKEE 46, WIS.

the P&H Line

P&H welding equipment is manufactured and sold in Canada by HARNISCHFEGER MANUFACTURING COMPANY LTD. 402 King Street West • Toronto, Ontario, Canada

3800A

on the same lands are entirely separate matters. A person granted a uranium lease by the commission definitely does not have to secure permission, concurrence, or anything from the holder of an oil and gas lease.

You will note, however, that the commission does require a uranium lessee to operate in such a manner that he will not interfere with the lawful operations of an oil and gas lessee, as you correctly stated in the last paragraph of your article. . . .

. . . Doubtless, many of your readers have been confused by the February 8 article, and you would be doing them a real service to set them straight. . . ."

Sheldon P. Wimpfen
Manager
Grand Junction
Operations Office
Atomic Energy Commission
Grand Junction, Colo.

Better Figures on Turbines

Sir:

I wish to call your attention to errors in your abstract appearing in the April 26 edition of The Oil and Gas Journal. This regards the paper which I presented before N.G.A.A. April 21 entitled "The Combustion Gas Turbine —An Appraisal of Its Status as a Prime Mover in Natural Gas Transmission."

In the left column, last paragraph, the figure 8,000 should be 81,000. In the middle column, first paragraph, the figure 4,000 should be 30,000.

I regret that these inconsistencies appear as many people who are unfamiliar with this equipment will be misinformed.

Tracy S. Park, Jr.
Tennessee Gas Transmission Co.
Houston, Tex.

Smog Solution Formula

"Only by intensive research to specifically identify the chemicals of importance in our atmosphere and to illuminate in detail the exact chemical mechanisms involved in important reactions can we hope to lay groundwork for a truly successful (smog) control program. . . .

"The community problem of contaminated atmosphere will never be solved in the newspapers or in legislative chambers. It can only be solved in the laboratory—and only solved there if the findings and programming of the research effort are free from political motivation and popular pressures. . . .

"The day may soon come when we will actually consider releasing additional chemicals into the air to inhibit reactions between contaminants for

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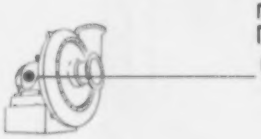

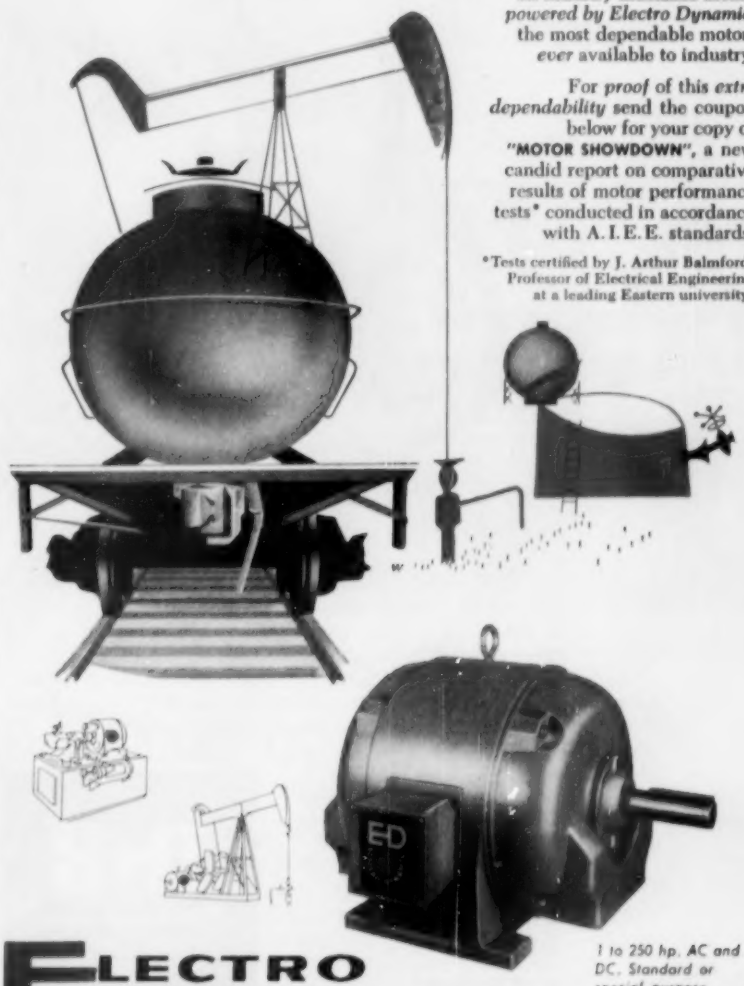

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which there seems to be no conceivable means of control."

W. L. Stewart, Jr., chairman of the American Petroleum Institute committee on smoke and fumes, at a meeting of the Air Pollution Control Association.

Doing a Favor

"Now admittedly it is a tough job to convince the average customer that you are doing him a favor by taking more money away from him for his monthly service. Yet, as surely as he values that service, and as surely as he would have to do without it if the company could not operate profitably, or could not attract enough capital to build and expand necessary plants, you are doing him a favor when you ask for required rate increases. Trying to make that argument understood, let alone making it stick, is one of the most challenging tasks that has ever confronted any business."

Francis X. Welch, editor of Public Utilities Fortnightly, in an address before the Southern Gas Association meeting.

California Controls Urged

"Shell Oil Co., as one of the largest producers of crude oil in the state, believes the people of California should understand the meaning of oil conservation and why it is important. . . .

". . . Thousands of items derived from petroleum constitute a vital part of our daily lives, making it all the more obvious why the conservation of oil is important to everyone in this state. . . .

"I would like to see a California law which would oblige operators in a given field to get together and agree on methods adaptable for best production results in that field."

H. S. M. Burns, president of Shell Oil Co., in Los Angeles press conference.

CALENDAR

MAY

17-19 American Petroleum Institute, Division of Marketing, midyear meeting, Cosmopolitan Hotel, Denver.

20-21 Kentucky Oil and Gas Association annual meeting, Lafayette Hotel, Lexington, Ky.

20-23 Mississippi Geological Society, eleventh field trip, Nashville, Tenn.

24-26 American Gas Association, production and chemical conference, William Penn Hotel, Pittsburgh.

27-28 Natural Gas and Petroleum Association of Canada, Prince Albert Hotel, Windsor, Ont., Canada.

31-June 5 American Petroleum Institute, Division of Production, midyear committee conference, St. Francis Hotel, San Francisco.

Another new development using

B. F. Goodrich Chemical *raw materials*

B. F. Goodrich Chemical Company does not make this rigid vinyl pipe. We supply the Geon resin only.

Right in the groove - rigid vinyl pipe

THIS is a part of a 3-mile installation of rigid vinyl plastic pipe in the oil fields of Ellis County, Kansas. It carries hot salt water—a corrosive by-product of crude oil—from a separating tank to a deep disposal well.

Oil company engineers chose *high-impact* rigid vinyl pipe made from Geon resin because it won't corrode, can stand roughest handling and has better chemical resistance. Another advantage: Money is saved in ditching operations for other pipe made of brittle materials must be cradled in a more costly graded ditch to avoid damage.

This high-impact rigid vinyl pipe has so many advantages that it may suggest a use to you or may give you an idea for an equally successful product. There are scores of other uses for Geon materials—from rigid sheets and panels to flexible colorful upholstery, wire insulation, durable flooring, sponge and many more. For information on Geon materials, please write Dept. HJ-6, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

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JUNE

2-4 Southern Gas Association, short course in gas technology, Texas College of Arts and Industries, Kingsville, Tex.

3-4 Pennsylvania Grade Crude Oil Association, thirty-first annual meeting, Hotel William Penn, Pittsburgh.

6-11 Society of Automotive Engineers, Summer meeting, Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J.

13-18 American Society for Testing Materials, annual meeting and exhibit, Sherman and Morrison Hotels, Chicago.

14-17 Twenty-sixth annual confrence and exhibit, Oil and Gas Division of the American Society of Mechanical Engineers, Hotel Muehlebach, Kansas City.

17-19 American Petroleum Institute, Division of Production, eastern district meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

17-19 National Oil Scouts and Landmen's Association, annual meeting, New Orleans.

20-24 Canadian Gas Association, Banff Springs Hotel, Banff, Alta., Canada.

20

July 4 Seventh annual Conferences on Personnel Administration and Managerial Development, Industrial Relations Section of the California Institute of Technology, California Institute of Technology, Pasadena, Calif.

21-25 Gordon Research conferences, conference on petroleum, Colby Junior College, New London, N. H.

24-25 Western Petroleum Refiners Association, regional meeting, Leonard refineries auditorium, Alma, Mich.

27

July 1 Petroleum Equipment Suppliers Association, nineteenth annual meeting, Manoir Richelieu, Murray Bay, Que., Canada.

JULY

15 Southern Gas Association, conference on radio communications for pipelines, Adolphus Hotel, Dallas.

16 Southern Gas Association, dispatchers' conference, Adolphus Hotel, Dallas.

29-31 Wyoming Geological Association, ninth annual field conference, Casper, Wyo.

AUGUST

13 Southern Gas Association, conferences on pipeline operations and pipeline engineering, Rice Hotel, Houston.

16-18 Society of Automotive Engineers, West Coast annual meeting, Statler Hotel, Los Angeles.

20 Southern Gas Association, conferences on natural-gas gathering and natural-gas processing, Captain Shreve Hotel, Shreveport.

23-25 Fourteenth annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

26-28 (tentative) Intermountain Association of Petroleum Geologists, fifth annual field conference, beginning at Price, Utah.

SEPTEMBER

7-9 Association of Desk and Derrick Clubs of North America, annual convention, Banff Springs Hotel, Banff, Alta.

8-10 Pacific Coast Gas Association, sixty-first annual meeting, Vancouver Hotel Vancouver, B. C.

9-11 Interstate Oil Compact Commission, Omaha, Neb.

10 Southern Gas Association, conference

Case No. 64

Kemp Dryer Assures Accuracy For Sun Oil Co.

How SUNOCO® guarantees dependable instrument readings 24 hours a day

WHEN the Sunoco Plant at Marcus Hook, Pa., introduced a new process at the beginning of the year, many new instruments were installed. To dry the compressed air operating these instruments and assure accurate readings, Sunoco installed a Kemp Model 300 S Dryer

Kemp Dryer Entirely Satisfactory

According to Harold Powers, Instrument Supervisor at Sunoco, the Kemp Dryer has been entirely satisfactory in performance. Operating continuously day and night since installation, it has performed according to specifications, has never been saturated, and has required very little attention.

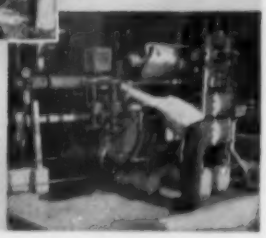
Kemp Dryers for Every Purpose

Kemp offers a variety of dryer models to meet all problems. Designed to dry air to sub-zero dew points at low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. They are available with manual, semi-automatic, or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each specific drying job. If you have a problem involving the removal of water from air, gases, or liquids, contact Kemp engineers now.

KEMP INERT GAS GENERATORS, too, serve Sunoco well

Sunoco reports that its two Kemp Inert Gas Generators have given highly satisfactory service. They are easy to start, and then operate automatically, requiring little attention. Both deliver high volume of gas of the proper analysis regardless of demand.

Kemp Inert Gas Generator Model C-5 MHE. Delivers N_2 and CO_2 used to blanket top of wax tank.



Kemp Inert Gas Generator Model 8 MHE. Produces N_2 and CO_2 for blanketing and for bubbler systems. Located in the open.

For more complete facts and technical information, write for Bulletin D-27 to:

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Make SURE machinery keeps operating

• For the solution to lubrication difficulties, or chemical feeding problems, more and more companies are turning to Manzel.

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Chemical Feeders are used throughout the oil industry to keep wells and pipelines in good, flowing condition. *But,* in wet gas fields corrosion frequently stops the motors that power these feeders.

To solve this problem, Manzel developed a chemical feeder with built-in automatic force feed lubrication which protects the gas motor from corrosion and insures continuous operation of the feeder.

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FORCE FEED LUBRICATION
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on compressor-station operation, Jung Hotel, New Orleans.

12-16 American Institute of Chemical Engineers, Colorado Hotel, Glenwood Springs, Colo.

13-14 Independent Natural Gas Association of America, annual meeting, Roosevelt Hotel, New Orleans.

15-17 National Petroleum Association, fifty-second annual meeting, Traymore Hotel, Atlantic City, N. J.

16-17 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

23-24 Western Petroleum Refiners Association, regional meeting, Henning Hotel, Casper, Wyo.

27-29 Electrical Conference for Petroleum Industry, American Institute of Electrical Engineers, Mayo Hotel, Tulsa.

27-30 Ninth Annual Petroleum Mechanical Engineering Conference, petroleum division of the American Society of Mechanical Engineers, Statler Hotel, Los Angeles.

30 Southern Gas Assoication, conference on transmission management, Shamrock Hotel, Houston.

OCTOBER

1 Southern Gas Association, conference on gas pipeline rights-of-way, Rice Hotel, Houston.

4-6 Texas Mid-Continent Oil and Gas Association, annual meeting, Plaza Hotel, San Antonio, Tex.

4-6 Petroleum Electric Power Association, twenty-sixth anniversary meeting, Jung Hotel, New Orleans.

6-8 Eighteenth Technical Conference on Petroleum Production, Pennsylvania State University, State College, Pa.

7- 8 California Natural Gasoline Association, twenty-ninth annual fall meeting, Ambassador Hotel, Los Angeles.

7-8 American Institute of Mining and Mettallurgical Engineers, Pacific Petroleum chapter, fall meeting, Biltmore Hotel, Los Angeles.

11-13 American Gas Association, annual convention, Atlantic City, N. J.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Biltmore Hotel, Los Angeles.

12-15 Eighth National Chemical Exposition, Chicago Coliseum, Chicago.

14-17 Permian Basin Oil Show, Odessa, Tex.

17-20 American Institute of Mining and Metallurgical Engineers, petroleum division, fall meeting, Plaza Hotel, San Antonio.

24-26 Independent Petroleum Association of America, annual membership meeting, Mayo Hotel, Tulsa.

26-27 Society of Automotive Engineers, national diesel engine meeting, Statler Hotel, Cleveland.

NOVEMBER

4-5 Society of Automotive Engineers, national fuels and lubricants meeting, Mayo Hotel, Tulsa.

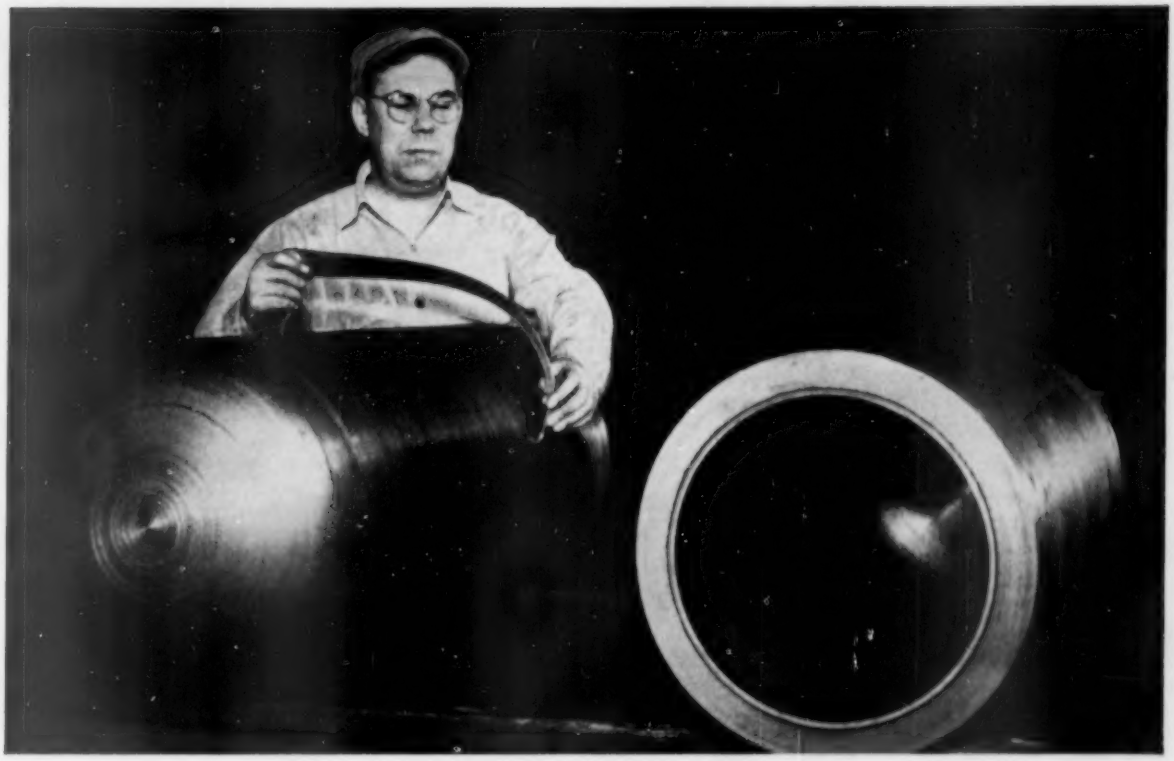
5 Southern Gas Association, conference on field production of natural gas, Herring Hotel, Amarillo.

8-11 American Petroleum Institute, thirty-fourth annual meeting, Conrad Hilton Hotel and Palmer House, Chicago.

28-Dec. 3 American Society of Mechanical Engineers, Statler Hotel, New York.

DECEMBER

2-4 Interstate Oil Compact Commission, winter meeting, Drake Hotel, Chicago.



We Can Get Them to You Fast

Here are two of the numerous shapes that can easily be made by Bethlehem's pierce-forging process. This is a method that produces hollow forgings in many sizes and types, and that does the production job so fast that excellent deliveries are possible.

Almost any small or medium-sized piece that is roughly cylindrical in shape can be handled by this process. Examples: shells for separator systems . . . pump liners with or without integral collars . . . nozzles, journal forgings, commutator shells, etc.

Bethlehem pierced forgings are available in carbon or alloy steel, heat-treated or untreated. They are furnished rough-machined so that the customer is saved a costly operation in his own plant. And they're economical, too—something we'll be glad to prove by quoting on your needs.

Why not ask for full details? These sturdy, low-cost forgings have many advantages that could be useful to you.

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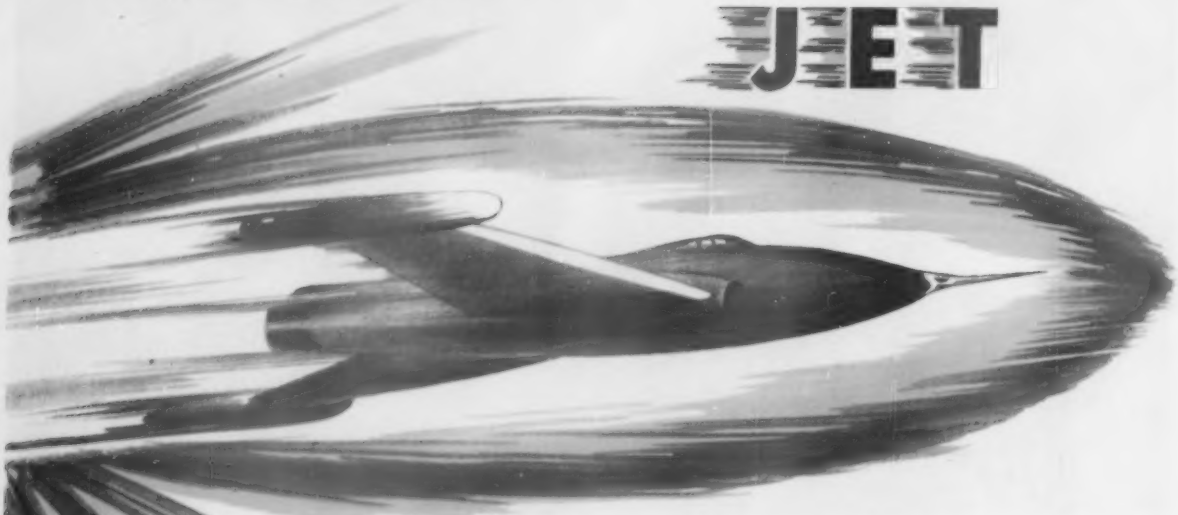
From a Jenny TO A JET



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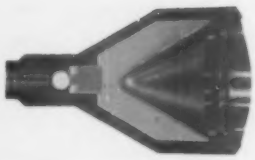
No one derided old bi-plane crates when they were the best available, but they disappeared when better planes were developed. Most operators today are convinced of the superiority of modern jet perforating over older methods . . . have switched over because they get more positive perforating . . . deeper penetrations from Welex Jets. To guarantee better results . . .



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THE OIL AND GAS
JOURNAL
TULSA, OKLAHOMA

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JOURNALLY Speaking

Fireman, Save My Tank

A DEMONSTRATION that a pipeline system is a lot more than just "glorified plumbing" was made by Sinclair Pipe Line Co. in handling a 1,000-mile phone call to send a fire truck 5 miles.

Near the town of Pontiac, in central Illinois, lightning struck Sinclair's pump station and set a tank of oil on fire. The bolt also knocked out the station's telephone line into town, 5 miles away. So the station operator simply picked up the phone on Sinclair's own private communications system and instantly got the dispatcher in the main office in Tulsa, 500 miles away. The dispatcher put in a long-distance call through the commercial system, got the Pontiac firemen, and asked them to send a truck out to the edge of town and put out the fire at the tank farm—which they did with neatness and dispatch. Damage was confined to the single tank hit by lightning.

That ought to give pause to the disciples of automation, who are working on schemes to hook up pipeline communication systems with remotely operated instruments and controls so that the whole system can be operated by a single push buttom. How are they going to make a robot that can figure out how to call the fire department when the phone's out of order?

Ventura Ventures

FROM Ventura, Calif., come two bits of petroleum lore, one old, one new, which provide some interesting sidelights on the perseverance and ingenuity of oil men in their never-ending quest for the elusive pay sand.

Back about the time of the Civil War, very shortly after Drake's well in Pennsylvania had demonstrated that oil could be obtained from rock, Ventura County was producing oil from the many seeps around Sulphur Mountain where the sedimentary strata stand exposed and nearly vertical. Tunnels were cut into the side of the mountain, some as far as 700 ft., from which oil and water were bled from the mountain's vitals and drained into separating tanks. There was so much gas in the tunnels that open lamps could not be used, so the tunnels were ingeniously lighted by sunlight reflected from mirrors. Several men were killed by gas and cave-ins, but the operation was continued for many years.

By 1896 Ventura County was producing 1,000 bbl. of oil per month from tunnels and 4,000 bbl. per month from wells. This fairly well demonstrated the superiority of drilling over mining as a means of recovering oil, and since then oil-well drilling has made great progress in Ventura.

Today, two of the best known and most highly skilled drillers in Ventura are Ralph Smith and "Shorty" Sauder, both tool pushers for Pike Drilling Co. Until very recently both were locally famous for two things—their ability to handle the toughest drilling jobs, and the fact that neither had ever brought in a successful wildcat. They were known as the "dry-hole twins," and it was said that if you wanted a dry-hole well drilled, get Smith or Sauder for the job.

But now comes the Horatio Alger ending. Recently both men have brought in good producing wells in Ventura County following highly complex drilling jobs. Both wells were directionally drilled to great depths, both complicated by sidetrackings, high pressures, and other difficulties.

These two Ventura items don't prove much of anything except that success in the oil business always has been compounded with a mixture of failure, perseverance, and experiment.

Texas' Brags

TEXAS brags that everything it has is bigger and better than anyone else's—including its brags. Next week our favorite oil publication will have a few words to say about Texas which will prove that when Texas brags about its oil and gas industry it has the stuff to back it up.

—Henry D. Ralph.

Keep Cement
WHERE YOU WANT IT

with BAKER "METAL PETAL" BASKETS

Where a lower zone must be protected from contamination by the cement slurry (as well as from sloughings and cavings) the Baker Metal Petal Basket will be found both safe and successful.

The unit is constructed of a number of individual "petals" made of flexible sheet metal. These petals are mounted on reinforcing spring steel ribs, which in turn are mounted on a ring to form a Basket.

When running-in the hole, the upward pressure of the fluid tends to close the "petals" thus providing fluid passageway between the Basket and the walls of the hole, without distortion of the Basket. As soon as the Basket comes to rest, upward pressure by the fluid is relieved and the petals expand to contact the walls of the hole. Any tendency of fluid to move downward then presses the flexible petals more firmly against the entire circumference of the hole. Solids strained from the fluid tend to build a bridge inside the Basket which is thus converted into a one-way, open hole packer of great strength and effectiveness.

SIMPLE, EFFECTIVE ACTION

The "Metal Petals" not only expand to contact the circumference of large-diameter holes, but also pack-off in holes of irregular shape; and the independent action of the individually mounted overlapping petals permits successful use of the Basket in casing programs with minimum clearances.

All-metal construction and design provide ample strength; lessen the possibility of splitting or otherwise damaging the Basket.

Baker Metal Petal Baskets are "slidably" mounted to permit rotation, spudding, or reciprocation of the casing without distorting or damaging the Basket.

MOUNTINGS TO MEET ALL NEEDS

Baker Metal Petal Baskets are furnished mounted on plain or perforated nipples; with or without different types of Baker Whirler Float Collars; for a wide range of cementing applications.

Maximum efficiency of Baskets is assured when Baker Casing Centralizers are used immediately below and above the Basket Assembly.

Ask any Baker representative for specific recommendations as to how Baker Metal Petal Baskets solve specific cementing problems

BAKER OIL TOOLS, INC.
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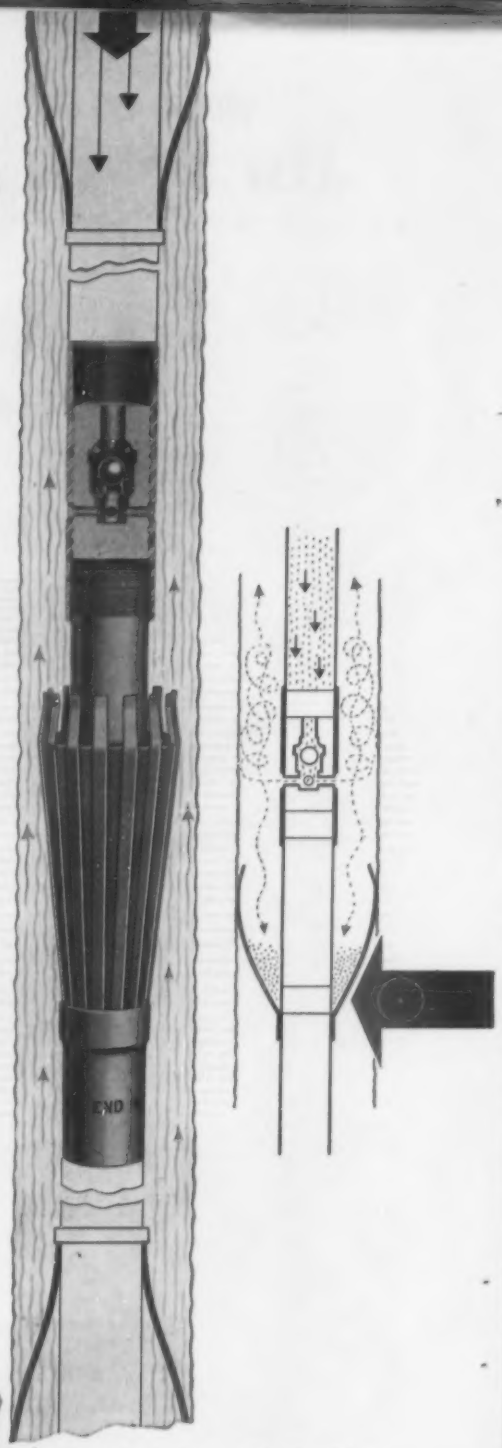


A popular hook-up consists of a Baker Metal Petal Basket mounted on nipple, with a Baker Cement Whirler Float Collar with Solid Baffle (Product No. 305) which whirls the cement slurry outward and upward through the baffled, side-whirler ports.

BAKER
"METAL PETAL"
BASKET
PRODUCT NO. 340

The overlapping "petals" (each mounted on its individual spring steel rib) provide flexibility and freedom of expansion to pack-off around the circumference of large-diameter holes, or holes of irregular contours.

Mid-Continent producers face a bitter choice

A SURPLUS of crude oil in Oklahoma is reaching serious proportions, dramatizing a condition which is developing, to a greater or lesser degree, in many other producing areas of the country.

For several months Oklahoma has been producing more crude than its traditional markets want from it. Storage is mounting, some pipeline proration has been instituted, and there are rumors of imminent price cuts.

This is the cumulative result of several factors: An ample supply of crude everywhere, including imports; loss of the Canadian export market; flush production in the Rockies reaching the Wood River-Great Lakes refinery market through the Platte pipeline; a big increase in Oklahoma's producing capacity; and failure of the state's regulatory commission to keep a close check on actual production and market demand.

MID-CONTINENT PRODUCERS think they are encountering cut-price competition. The facts are elusive, but it seems clear that in many areas the producer's net price at the well is considerably below the Mid-Continent gravity scale and that Midwest refiners are finding it profitable to shift from Mid-Continent to Rocky Mountain and other crudes for a combination of price and quality reasons.

What should Oklahoma do? What should any producing area do when its markets are being lost to cheaper oil? The problem is as old as flush production. There are two choices:

- Produce heavily, cut prices, and fight for markets, even though many operators go broke.
- Prorate back to market demand, conserve resources, and let unprorated oil have its fling.

The first course would be preferable and traditional in almost any other commodity. But in oil, conservation of an irreplaceable resource requires proration to preserve higher-cost producers.

OF COURSE, EVERYBODY should prorate to market demand—importers, the Rockies, and other states. But the prorating states that pioneered in conservation should not surrender now.

Oklahoma (and Kansas and Texas) should do these:

- Show they believe in proration by cutting back to realistic estimates of market demand (plus perhaps some price adjustments for less-wanted grades of crude).
- Preach and teach and fight harder than ever to induce other producing areas—foreign and domestic—to limit supplies to market demand —not for the selfish purpose of protecting old markets against new competition but to preserve and extend the proven principle that oversupply means waste and irreparable loss of a national resource.

ACCO products

CAST STEEL

PRESSURE CLASSES FROM 150 TO 2500 PSI

• R-P&C's cast steel valve line includes gate, globe, angle, swing check and lift check styles in a wide variety of sizes, pressure classes and body and trim materials. Typifying the quality construction of the entire cast steel line is the valve illustrated at left, the

fig. 1501—This popular OS&Y flanged end gate valve has a primary rating of 150 psi at 500° F. It is furnished in sizes from 1½" to 24". Construction features that lengthen valve life, lower maintenance requirements, include:

wedge and wedge guides—Solid I-beam type wedge for maximum resistance to distortion. Wedge guides, cast to true center of seating surfaces, guide wedge to a perfect seat—make contact only at point of closure.

seat rings—Bottom-seated type, of heavy uniform cross section. There are no points of high stress concentration. Broad seat contact and smooth finish give longer life, less wear. Port openings are full pipe diameter for lower pressure drop.

stainless steel trim—Regularly furnished with 12-14% chromium trim for greater corrosion resistance. Other trim materials, suitable for a wide variety of special services, furnished on request.

stem—Head forged integral engages wedge slot, provides self-alignment.

packing—Long fibers of 95% chrysotile asbestos are square braided and reinforced by wire insertions, lubricated with graphite and oil. This special packing produces tight joints at high temperatures and pressures, lowers stem friction, decreases maintenance requirements.

castings—All castings produced in R-P&C's own foundry under careful metallurgical controls. Conform fully to requirements of standardization societies and customers' specifications.

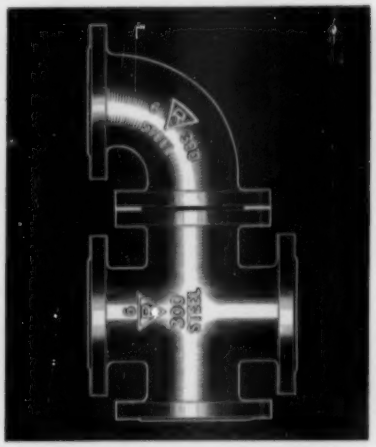
for further information on Fig. 1501 or other R-P&C cast steel valves, write for Catalog 9

VALVES from 1½" to 24"!

FROM R-P&C's COMPLETE LINE

Pressure sealed bonnet joint cast steel valves are furnished in gate and globe valve styles in 900 lb., 1500 lb., and 2500 lb. pressure classes.

Bar stock valves are precision machined from highest quality bronze, carbon steel, or alloy steel bar stock. Working pressures for carbon steel range from 10,000 lbs. at 150°F to 475 lbs. at 1,000° F. Sizes from ⅛" to 1".



Cast steel fittings, ells, tees, laterals, crosses, reducers — screwed or flanged ends. Furnished in a wide variety of sizes up to 24", in pressure classes from 150 lbs. to 2500 lbs.

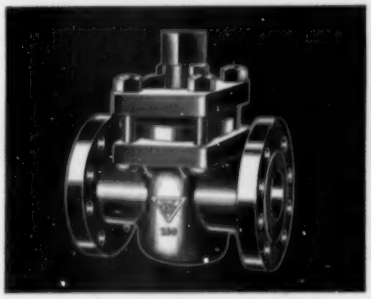
THE SECRET OF R-P&C's BETTER VALUES— QUALITY CONTROL

• A vital component of each R-P&C Valve is an ingredient you can't see. This hidden ingredient insures that you get the trouble-free operation and longer life engineered into each R-P&C design.

This hidden ingredient is called "quality control." It is a philosophy that dominates every step of the manufacturing operations that produce each R-P&C Valve.

Castings for every R-P&C Valve are produced in our own foundries under careful metallurgical controls. Casting soundness is verified by special radiographic techniques using radium or radioactive isotopes. Dimensional accuracy of each valve part is checked by a variety of gauging methods, including some specially developed by R-P&C engineers.

Before it leaves the factory, the performance of each valve is proved by individual hydrostatic and other tests. These tests are normally conducted at pressures higher than those for which the valves are rated.



Asbestos-packed cocks, an R-P&C exclusive, are furnished in iron in sizes from ¼" to 6" with screwed or flanged ends.

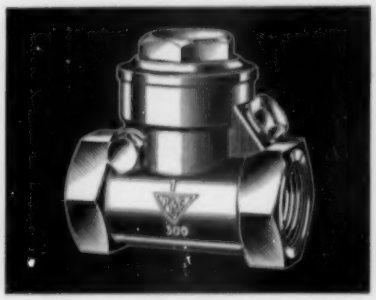


Fig. 212 screwed end bronze check valve typifies R-P&C's complete check valve line — furnished in iron, bronze or cast steel in sizes ranging from ¼" to 24".

WHICH OF THESE HELPFUL TECHNICAL AIDS DO YOU WANT?

R-P&C provides a wide variety of free technical aids to assist the buyer in valve selection, installation and operation. Among these are:

Valve Selector Slide Rule. Handy selector slide rule gives all dimensions for iron body valves, steel valves in 150, 300, 400, 600, 900 and 1500 lb. classes.

How To Select Valves. 17" by 11" wall chart lists principles to use in selecting valves for various applications . . . considers effects of fluids, temperatures, pressures, sizes, service requirements.

How To Protect Your Valves. 17" by 11" wall chart lists 22 installation and operation pointers to protect valves, get maximum life.

How To Know Valves. 17" x 11" wall chart graphically illustrates appearance, construction, operation, recommended applications for gate, globe and check valves, cocks.

Any of these free technical aids furnished promptly on request
Write R-P&C Valve Division, American Chain & Cable, Reading, Pennsylvania

ACCO

R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

PROBLEM WELL MADE PROFITABLE WITH

ELECTRIC PILOT

Oil increased 80%, water eliminated after Dowell selective acidizing, permeability & water location surveys

A well completed in a limestone formation was pumping 61 barrels of oil and 85 barrels of water per day. The operator called Dowell to help him with the workover.

Dowell engineers used Electric Pilot services to help bring the well's production to a profitable 109 barrels of pipeline oil per day flowing. Here's the way the job went.

A water location survey showed that the water was entering the hole at the bottom of the upper set of perforations. A relative permeability survey using the spinner, indicated that approximately 86% of the permeability was in the upper set of perforations with over 50% at the point of water entry.

Then, as a final step, the lower perforated zone was acidized selectively with the pilot. A packer isolated the water zone during and after the treatment. The resulting 109 BOPD, flowing, was recorded with the well "pinched in" and *after* a period of flush production.

Other wire-line services performed with the Electric Pilot include Glass Gun perforating; caliper, temperature and channel determination surveys; and Gamma Ray Logging. For complete information on the Electric Pilot and the many other Dowell services—including fracturing and acidizing—contact your nearby Dowell office. Or write to DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. E-11.

DOWELL SERVICE

chemical services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

THIS WEEK . . . . . IN THE NEWS

THIS TALL HOUDRIFLOW cat cracking unit dominates the new, ultramodern refinery of Sun Oil Co., Ltd., at Sarnia, Ont. The new plant, dedicated last week, has a daily capacity of 15,000 bbl. Many modern processes and techniques are found in this latest addition to Canada's "Chemical Valley." For details of the new refinery see page 80 of this issue of your Journal.

OFFSHORE—New regulations of Interior Department governing oil operations on the Continental Shelf go into effect. . . . Competitive bidding provided in new rules. . . . Indications are that nearly all state-issued leases now on federal lands will be validated. . . . ¶Humble outlines $14,000,000 offshore program for remainder of this year. . . . Program includes three 14,000-ft. wildcats, construction of seven platforms.

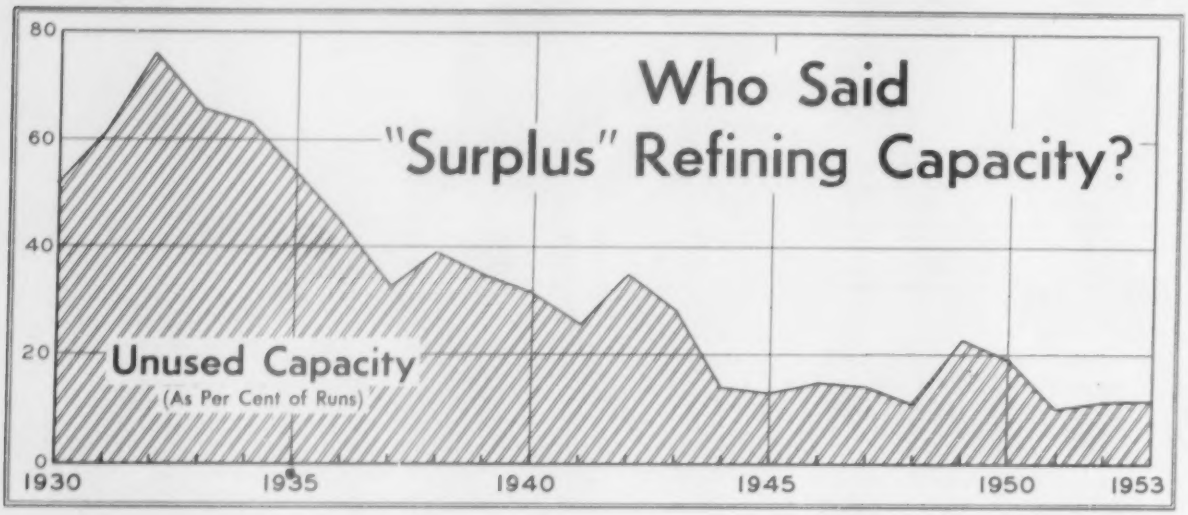
INTERNATIONAL—Deadlock develops in Iranian oil negotiations over question of who will control the revived industry. . . . Both Iran and the eight-company consortium insist on having management control when production and processing operations are resumed. . . . ¶Socony-Vacuum, Shell, and Caltex seek exploration permits under new Turkish oil law. . . . ¶International Egyptian completes second well on Sinai Peninsula of Egypt. . . . Well flows 50 bbl. an hour of 22.8°-gravity crude. . . . ¶Latest dry hole dampens enthusiasm of wildcatters in Peru's Sechura Desert.

PIPELINES—Participants in plan to build 24-in. crude line from Williston basin to Great Lakes market area shelve idea as not economical. . . . Alternate plans for individual lines are now being studied. . . . ¶Northern Natural Gas offers to build a gas line in North Dakota in brief filed in opposition to North Dakota Natural Gas Transmission plan for a line. . . . Omaha company offers to build the line this year. . . . ¶FPC attorneys recommend that neither Pacific Northwest Pipeline Corp. nor West Coast Transmission Co. be granted certificate to serve Pacific Northwest. . . . Lawyers say proposals by both companies are incomplete.

REFINING—Socony-Vacuum will close 6,500-bbl. refinery at Olean. . . . Shutdown will be coordinated with completion next fall of the 35,000-bbl. refinery at Ferndale, Wash., which is owned by General Petroleum Corp., a Socony-Vacuum subsidiary. . . . ¶Consumers Cooperative Refinery Association's refinery at Levelland auctioned to Houston Bank of Cooperatives for $70,000. . . . ¶Arthur E. Pew, Jr., Sun Oil director, received Certificate of Appreciation from Division of Refining of A.P.I. . . . ¶A.P.I. refining meeting told preignition looms as principal obstacle to higher compression ratios in new car design. . . . General Motors representatives say control by automotive design is limited. . . . ¶Universal Oil Products and British firm will build platinum catalyst plant in England under the United States Foreign Operations Administration guaranty program. . . .

EXPLORATION—Commercial production in southeastern Saskatchewan indicated by Canadian Gulf tests. . . . Light gravity crude recovered from wildcat located 19 miles east of another discovery well. . . . ¶Gulf resumes drilling on West Texas depth record well 24 miles southeast of Pecos. . . . Operations had been shutdown since May, 1953. . . . ¶Magnolia makes distillate strike in rank wildcat territory of western Anadarko basin. . . . ¶Stanolind enters Saskatchewan scene by receiving exploration permit covering more than 1 million acres. . . .

PRODUCTION—Drilling fluids can materially and permanently reduce the permeability of sandstone reservoirs, researchers tell Pacific district of A.P.I. . . . Tests indicate the permeability damage of cores increases with the time of exposure to drilling fluids. . . . ¶Chemical inhibitors prove to be the most effective means of combating corrosion in California pumping wells. . . . A.P.I. told the inhibitors resulted in 51 per cent reduction in repair jobs. . . . ¶Texas Railroad Commission approves four new water-flood projects. . . . One, in North Ward-Estes field expected to result in recovery of additional 11,000,000 bbl. of oil. . . .



- **Unused capacity is only about 12 per cent of refinery runs, almost a record low in more than 20 years**
- **On paper it's a million barrels, but variable demands, down time, marginal facilities have always kept runs well below the nation's rated capacity**
- **The present "excess" capacity isn't new, but soft markets, lower realization have focused attention on it**

John C. Casper

REFINING capacity is not excessive. In fact, the spread between total capacity and capacity in use has tended to shrink rather than expand.

The volumetric difference between capacity and runs has been quoted in recent months in an attempt to prove that the capacity is excessive.

This difference may amount to as much as 1,000,000 bbl. daily, but this does not take into consideration the fact that refineries of the country never have and never can operate at 100 per cent of reported capacity.

The relatively small amount of unused capacity in recent years cannot be classified as surplus since refiners must have some reserve capacity to meet increased demands for heating oils that come with colder weather.

Weather factor . . . Heating oils in recent years have been accounting for increasingly larger portions of total demand. Since heating oil demands depend on the weather, refiners must have some standby capacity to meet the peak loads resulting from colder-than-normal weather.

Weather has been warmer than normal for several of the years since the war. It has been estimated that demand for some of these years was reduced by as much as 100,000 bbl. daily because of warm weather. It is quite possible for demand to move at least 100,000 bbl. daily above normal in years with very cold winters. Thus, the variations in demand between a warm year and a cold year can amount to at least 200,000 bbl. daily.

Since several winters in recent years have been warmer than normal, some suppliers have tended to estimate winter heating-oil requirements a little lower than would be required with normal weather, expecting to cover emergencies with increased runs.

The difference of 100,000 bbl. daily between normal and cold years is spread over the entire year. If the difference is crowded into a 6-month period, the effect is doubled for a gain in demand of about 200,000 bbl. daily. Also, this demand is for products representing less than 50 per cent of refinery yields. To meet an increase in heating oil demand of 200,000 bbl. daily would call for a gain of at least 400,000 bbl. daily in crude runs.

Refiners would have had trouble meeting heating-oil demands this past winter if weather had been unusually cold.

Why the emphasis . . . Attention has been focused on refining capacity in recent months by the decreases in realization from a barrel of crude. These drops in value of products resulted

In the Chart . . .

THE above chart shows a comparison of refining capacity and refinery runs for the period 1930 through 1953. The capacity for any given year is assumed to be the average of capacities at the beginning and end of the year. Refinery use is expressed in terms of average crude runs for the year.

The shaded area represents percentage differences between total average capacity and average runs. The plotted point for 1940 is 32, meaning that the average refining capacity for that year was 32 per cent greater than daily average crude runs.

Note the downward trend of the line from 1932 through World War II. Since the end of the war, the difference between capacity and runs has been above 20 per cent only once. This postwar high was in 1949, when refinery runs decreased and part of the product demand for the year was supplied out of inventories accumulated during 1948.

Average refining capacity in 1953 was only 12 per cent greater than refinery runs. The only years in the past with runs nearer to capacity were 1948 with 11 per cent and 1951 with 10 per cent.

from soft markets, and the soft markets were due to surplus product stocks. In most cases, these surplus stocks could have been carried without too much trouble if the burden had been distributed among all suppliers.

A few refiners were caught with stocks that had to be moved. Since the products did not move at normal market prices, quotations were lowered until sales were made. Despite the fact that other suppliers were able to store surplus products, the distress sales tended to govern the market.

Some of the unjustified price decreases could be avoided if more suppliers had enough storage to care for the relatively moderate increases in stocks that come when demand drops lower than expected.

The industry needs more storage rather than less refining capacity.

SOUTHWEST

Deep Limes Expand

T.P.R.C. symposium on Glen Rose fields of East Texas told importance of Rodessa and Pettit limes will be increased

TYLER, Tex.—The Rodessa and Pettit limes are now the object of more wildcatting in Northeast Texas than any other horizon except the prolific Woodbine sand and future exploration will likely increase the importance of these deep lime reservoirs.

This view was expressed by R. W. Eaton of P. G. Lake, Inc., and John L. Read, Jr., of W. H. Bryant interests before a symposium here on the deep lime (Glen Rose) oil fields of East Texas. The meeting was sponsored by the Texas Petroleum Research Committee and attended by engineers, geologists, and operators from a wide area.

The Glen Rose in Northeast Texas is found at depths ranging from 4,700 to 10,800 ft. and includes the Pettit, Pine Island, James, Rodessa, Ferry Lake, Mooringsport, and the upper Glen Rose formations. However, according to Eaton and Read, the Rodessa and Pettit horizons are the most important reservoir rocks of the group and already have accounted for 14 per cent of past oil production in Northeast Texas, excluding the East Texas field.

Glen Rose characteristics . . . Traps for oil and gas, they said, are approximately 50 per cent simple anticlinal or domes and 3 per cent fault traps. The remainder are either stratigraphic without structural closure or anticlines with varying porosity and permeability being important trap-making factors.

Eaton and Read said the Rodessa fields have an average net pay thickness of 19 ft. and have produced more oil and condensate but less gas than the Pettit. While Rodessa wells produce from an average depth of 7,500 ft. in accumulations of 6,400 average net productive acres, the Pettit fields average 20-ft. net pay at 7,500 ft. in 15,000-acre accumulations.

The Pettit fields have produced the lion's share of East Texas gas, largely from the county-size Carthage field.

G. J. Loetterle, consulting geologist of Tyler, observed that there is commonly no effective water drive in any of the Glen Rose reservoirs, and the oil recovery mechanism is either solution gas or gas-cap drive. The dissolved gas-oil ratios are usually on the high side and gradually increase as the wells are produced. Correspondingly, the shrinkage from reservoir to stock tank is high.

Also, he said, porosity and permeability are of a low order as compared to those found in most sand reservoirs.

Oil recovery, Loetterle told the group, under primary conditions is uniformly of a low order in the Glen Rose reservoirs. On an acre-foot basis the recovery amounts to 15 to 35 per cent of the oil in place, and 20 per cent is close as an average primary figure.

High-pressure process . . . In order that these low recovery figures be brought higher, E. R. Brownscombe of the Atlantic Refining Co., Dallas, suggested that the "high-pressure gas process" be investigated in the deep limes. Brownscombe placed the gas-pressure requirements for this method in excess of 3,000 psi., and said that it is particularly applicable in those deep reservoirs which are saturated with the constituents of L.P.G. and natural gasoline.

He cited the Block 31 field of Crane County, Texas, as an example. Natural depletion would produce only 25 per cent of the oil in place. Water injection could raise this figure to 40 per cent. Atlantic's high-pressure gas process is expected to result in 52 per cent recovery of all oil in place.

Other processes . . . That other type projects for increasing recovery can be profitable in Glen Rose fields was shown by T. W. Clay of Lone Star Producing Co., Dallas. Clay said that the pressure maintenance by gas injection in the Opelika field of Henderson County appears to be very successful.

Clay told those attending the symposium that oil recovery already has exceeded the estimated primary oil recovery for similar fields in the area and that more than 90 per cent of the condensate initially in place in the gas cap will be recovered.

New nomenclature . . . Albert S. Trube of Tide Water Associated Oil Co., Houston, in describing a successful application of water injection in the New Hope field of Franklin County, called for a new system of nomenclature. Trube called the project "oil production by primary artificial frontal water drives."

He stated that the New Hope drives are "primary" in that displacement takes place above saturation pressure; they are "artificial" in that the water does not come naturally from an aquifer; and that they are "frontal" in nature as opposed to the pattern types of water drives now used in many secondary-recovery operations. The adaptability of the frontal flood to this particular project, Trube said, is reflected by the low present and cumulative water-oil ratios, high ratio of flowing to pumping production, and low lifting costs.

Deep Test Resumed

ODESSA.—Gulf Oil Corp. is resuming work at its 1 P. G. Northrup in Reeves County, West Texas. Present plans call for drilling out to around 18,500 ft. Gulf abandoned the test in May 1953 at total depth of 16,696 ft., which is a drilling depth record for West Texas.

The project is located 24 miles southeast of Pecos, but geologically it is in the southeastern portion of the Delaware basin. At its old total depth it was thought to be in Pennsylvanian beds.

Parker Drilling Co. holds contract, and was rigging up last week. Field sources reported the heavy-duty rig and pumping equipment is capable of drilling to 22,000 ft., if the operators decide to attempt penetration to pre-Cambrian rocks.

The present record depth holder in the basin is Richardson & Bass 1 Harrison-Federal, in the southeastern corner of Eddy County, New Mexico. This well was drilled to 16,705 ft., and at that depth was still in Wolfcamp sediments of lower Permian age. Currently, the well is testing a Permian sand around 12,320-12,335 ft. and making a small amount of gas and distillate.

Four Floods Approved

Gulf project in North Ward-Estes expected to recover 11,000,000 bbl. more oil; more applications submitted

AUSTIN.—The Texas Railroad Commission has approved four new water-flood projects in Texas—among them a project planned for North Ward-Estes field by Gulf Oil Corp. which would result in the recovery of an additional 11,000,000 bbl. of oil from the Yates sand.

Gulf's application is the biggest of a large number of water floods proposed for North Ward-Estes in recent months. The project takes in about 2,292 productive acres and 147 producing wells in the field, and it may be expanded later.

The company will convert more than 50 wells to injection service and drill about 24 more. It will drill another 11 wells as producers. The Yates sand is topped at an average depth of 2,600 ft. and averages about 28 ft. thick.

North Ward-Estes now contains about 22,600 acres and the exact limits of the field are still in the process of being defined. The reservoir is a north-south trending anticlinal structure with blanket shaly sands separated by impermeable dolomite with occasional sand stringers.

Water for injection will be obtained from the Delaware reef at about 3,700 ft. It will be injected in a closed-type system, employing a 20-acre, five-spot injection pattern along the lease boundary and a 40-acre, five-spot pattern in the central portion of the field.

The three other floods approved by the commission were proposed by:

... **Amerada Petroleum Corp.** for the 6,835-ft. Canyon Reef formation underlying North Van Reeder field in Borden County, West Texas. The commission also endorsed plans to unitize the 1,160-acre field, with Amerada as the operator. The flood, according to Amerada's estimate, will increase recovery to about 8,500,000 bbl. of oil—more than twice the 4,000,000 bbl. estimated to be recoverable under primary methods. There are 29 producing wells in the field. Water will be injected into both the oil column and below the oil-water contact through three wells at the edges of the field. More injection wells may be added in the future.

... **Harland Production Co.** also for the Yates sand underlying its Hathaway 1 lease in North Ward-Estes field at 2,600 ft. Harland will use two injection wells.

... **Tex Harvey Oil Co.** for the 1,390-ft. Pecan Gap formation under its C. M. Gillespie lease in Corsicana shallow field of Navarro County, East Texas. The flood, which involves converting 22 wells on the lease to injection service, is expected to recover well over half a million barrels of additional oil.

Applications for permits . . . The Railroad Commission received two applications to commence projects—one in Glen Cove field of Coleman County, and the other in Shackelford County Regular field, in Shackelford County. Both fields are in North Central Texas.

The proposal to unitize and conduct pressure-maintenance operations on properties in Glen Cove field was made by W. C. Woolf and N. H. Wheless Oil Co. It is the third such unit sought for the field and would take in nearly all of the remaining production outside the units operated by Andrew M. Howsley and the Luling Oil & Gas Co.

The project involves gas and/or water injection in the Jennings sand underlying about 534 acres at a depth of about 3,350 ft. The applicants told the commission that only about 960,000 bbl. of an estimated 4,721,000 bbl. in place could be recovered under the reservoir's primary solution-gas drive. Recovery with pressure-maintenance, they estimated, could be upped 1,051,000 bbl. to an ultimate figure of 2,011,000 bbl.

There are 26 wells in the proposed unit. Gas would be injected into the gas cap and the oil column through three wells. If water is injected it would be introduced below the oil-water contact and into the oil column in some places through nine wells in a closed system.

S-J.S. Oil Co. asked the commission to approve a flood it plans in the Fry sand underlying its Thompson-Street and Josh Thompson leases in Shackelford County Regular field.

Pipeline Bids Received

AMARILLO. — Shamrock Pipeline Corp., a subsidiary of Shamrock Oil & Gas Corp., has received bids for a 115-mile pipeline to extend from the McKee plant near Dumas, Tex., to Novinger field in Meade County, southwestern Kansas.

A 5-mile gathering system will be laid in the Novinger area in addition to the main pipeline. The line will have an initial capacity of about 2,000 bbl. per day.

Texas Producers Sold

ABILENE, Tex.—George A. Hughes, Jr., was reported last week to have sold his interest in 14 producers on four leases in Matilda Perkins field, Shackelford County, North Texas, to J. G. McMillian, Midland and H. W. Lee and Mrs. Grady Summers Lee of here.

The wells are on the B. C. Harvey, G. R. Davis, G. R. Davis "A" and W. D. Baker lease in Blocks 13 and 14, T&P survey. The purchase price was not disclosed.

Old Refinery Auctioned

LEVELLAND, Tex.—The 5,000-bbl. refinery built and operated here by Consumers Cooperative Refinery Association since the late 1930's was sold at public auction here last week for $70,000.

The plant was sold to the Houston Bank for Cooperatives. The bank held $127,400 in notes against the refinery. The auction was held to settle this indebtedness.

No plans for its reopening, sale or salvage has been announced.

The refinery had been shutdown for almost 2 years.

Tract Brings Big Bonus

DALLAS.—British-American Oil Producing Co. paid a cash bonus of $500 per acre to Texas Pacific Land Trust last week for an oil and gas lease on a 160-acre tract in southeastern Nolan County, Texas.

Texas Pacific Land Trust also will receive a royalty of 50 per cent of the oil and gas which may be produced from the acreage. The tract is about ½ mile south of the opener of EA (Cambrian) field and 8 miles north of Blackwell. It is immediately south of a lease upon which Humble Oil & Refining Co. recently completed one well and is in the process of completing a second in the Cambrian.

Gasoline Plant Started

LOVINGTON, N. M. — Otho H. Grimes, Tulsa, has started construction of a new natural-gasoline plant 6 miles southeast of here in Lea County, New Mexico.

The plant will be completed in about 6 months and will have a processing capacity of between 6,000,000 and 9,000,000 cu. ft. of casing-head gas per day.

Preignition Progress

Although far from solved, this problem is being attacked successfully by oil, chemical, and automotive researchers

George Weber

HOUSTON.—Judging from the recent frequency of special sessions devoted to it, the subject of preignition appears to be the most pressing problem facing refiners today.

The latest review was sponsored last week at the nineteenth midyear meeting of the A.P.I. Division of Refining.

From their relatively impartial viewpoints, authors from four companies contributed new data on test methods, control measures, and the effect of fuel components on irregular ignition tendencies. They agreed that preignition is a limiting factor in some new high output automobiles and that it looms as the principal obstacle to higher compression ratios in new car design.

Fuel ignition tendencies . . . Of the many factors involved in this problem, four members of Du Pont's petroleum laboratory in Wilmington reported new data on one—the relative tendencies of fuels to be ignited by hot deposits or surfaces. This study did not concern the contribution of various fuel types to the formation of deposits, nor did it relate to the role of fuel additives designed to alleviate preignition.

The study bore out previous findings on the ignition tendencies of several pure hydrocarbons. They follow no class pattern. While benzene, cumene, and ethyl benzene are most prone to ignite in proximity to hot surfaces, two other aromatics, toluene and xylene, showed relative high ignition resistance. The latter two showed qualities in this respect which were nearly equal to those of isooctane, cyclopentane, and methylcyclopentane.

These pure hydrocarbons showed no straight-line relationships in blends. For example, 50 per cent blend of isooctane with benzene reduced the number of pure benzene deposit-induced ignitions by roughly 70 per cent, and a similar blend containing 25 per cent benzene closely approached the quality of pure isooctane.

The absence of a fixed pattern presists in the results obtained in testing ignition resistance of commercial gasoline-blending stocks. While light alkylate stocks conformed to the superior results obtained on isooctane, polymer gasoline makes a relatively poor showing, and cat reformate showed relatively less tendency to ignite than might be expected in light of the poor results on pure benzene.

The effect of tetraethyl lead on the ignition tendencies of these stocks introduces further variables, according to Du Pont's findings. TEL will improve the ignition resistance of most fuels, but there are a few, such as benzene and toluene, which do not respond to the 3 ml. dosage. In general, TEL is found to increase the ignition resistance of those fuels to which it contributes knock resistance and has but a slight effect on low lead susceptibility stocks. Leading commercial gasoline stocks showed very significant reductions in ignition tendencies of polymer, cat cracked-straightrun, and cat reformed stocks, but practically none on light alkylate.

The authors said the ignition tendencies of fuels are but a part of the whole picture on preignition, other functions being the type of deposits present, the operating conditions of the engine, and engine design.

Automotive companies concerned . . . General Motors Corp. representatives said the control of preignition or particle ignition by automotive engine design is limited. G.M. feels that some type of chemical approach is required, they said. The problem is serious from their standpoint since they regard preignition as the main obstacle limiting the use of higher compression ratio automotive engines.

Tests have convinced them that a high percentage of some late model cars are limited in octane requirement by particle ignition.

Fourteen cars of one make and 32 of another, all customer-owned, were tested under a specified rating procedure. Commercial blends of gasoline in two research octane number increments were used for the rating. Knock was detected by ear and particle ignition was tested for by turning off the ignition key during acceleration periods.

A car was considered preignition-limited if it required a higher octane fuel to prevent firing of the engine with the ignition turned off than to

THIS SESSION of the Automotive Research Committee, headed by C. E. Davis of Shell Oil Co. (at the microphone) was one of 42 committee and subcommittee meetings which supplemented the 12 technical sessions of the nineteenth midyear meeting of the A.P.I. Refining Division in Houston. The meeting broke all records for attendance, with a registration of 1,752.

prevent light knock. Borderline knock was not considered a cause for failure, nor was occasional wild ping.

Under this set of rules, 13 out of 14 cars of one make and 22 out of 32 of the other were found to be preignition-limited. These and other tests have stimulated high interest among automotive companies, the G.M. authors said.

Research on the role of deposits indicated that the use of phosphorus additives increased the ignition temperature of the combustion chamber deposits and reduced the octane requirement of the engine. Fuel additives for the control of preignition are believed to act in a similar manner, they concluded.

Additive tests . . . Three representatives of Atlantic Refining Co., who have been testing various fuel additives, reported on investigations of phosphorus and nonphosphorus additives. While they found the phosphates to be the most effective of all types tested, they also found indications of wide differences from the standpoint of preignition effectiveness among individual members of any particular class of phosphorus compounds.

Their studies of additive side effects revealed a lowering of fuel octane by lead antagonism, reduced exhaust-valve life, engine octane requirement increase, increased engine varnish, and increased intake-port and intake-valve deposits. They recommended that these side effects be carefully investigated by those evaluating preignition additives.

Further contributions to testing techniques were presented investigators of Ethyl Corp. In reviewing their findings the Ethyl research team concluded that the point has been reached where preignition threatens to limit further advances. Engine designers, they said, are trying to do all that is possible to reduce this problem, but the important steps toward its solution appear to be in the refiner's hands.

Hyperformer Output

Blend of high-sulfur straightrun and visbroken naphtha to produce high-quality gasoline in first commercial unit

G. L. Farrar

HOUSTON. — High-quality gasoline stock from a blend of high-sulfur heavy straightrun and visbroken naphtha will be produced in the first commercial Hyperformer, which will be installed this fall in the Signal Hill, Calif., plant of Calstate Refining Co.

Clyde Berg, Union Oil Co., revealed the output of the Hyperformer during the annual A.P.I. Division of Refining meeting here.

The feed stock, Berg said, will be obtained from the operation of a 2,500-bbl. per day topping and rerun plant operating on Los Angeles Basin crude. It will consist of 600 bbl. daily of heavy straightrun naphtha and 400 bbl. daily of heavy thermally cracked naphtha obtained in visbreaking of the residuum produced in the plant.

Process flow for the new unit is essentially the same as when the process was announced except that the regenerator has been eliminated and catalyst regeneration is carried out in the Hyperflow lift line to the reactor *(For process flow see The Oil and Gas Journal, March 23, 1953, page 286).*

Processing results . . . Pilot-plant operations under conditions at which the unit will be operated show that:

. . . More than 95 per cent of the sulfur in the charge stock will be eliminated. The product will contain less than 0.01 per cent sulfur.

. . . Approximately 90 per cent of the nitrogen in the charge stock will be removed. The product will contain about 0.002 per cent nitrogen.

. . . Leaded research octane number, 3 ml. TEL per gallon, will be increased from 73 for the charge stock to 93 for the product.

. . . Volatility characteristics of the product will be much improved over the charge stock. The 50 per cent boiling point of the product will be 60° F. lower than that of the charge stock.

New technique . . . Blending straightrun naphtha with the inferior thermally cracked stock represents a new refining technique, Berg said. Using this technique, it is possible to refine high-sulfur stocks without the requirement of external hydrogen generation. This, he said, is of particular interest to refiners who must process inferior crudes.

The technique utilizes the hydrogen released in the dehydrogenation of naphthenes, largely supplied by the straightrun component, for the purpose of eliminating contaminants in the feed blend. The resulting efficient exchange of hydrogen between the straightrun gasoline and the inferior stock leads to refined gasoline of excellent quality, he said.

Process costs . . . Berg said capital investments for Hyperforming are moderate for these reasons:

. . . Recycle gas volume is low, making required heat-exchanger, furnace, and compressor facilities relatively small.

. . . Regeneration facilities are minor.

. . . Recycle gas of substantially constant composition is handled since operation is continuous with uniformly high catalyst activity. Gas-handling equipment does not have to be overdesigned to handle offgrade processing conditions.

Capital investment cost varies from $150 to $300 per barrel of daily capacity, depending on the capacity range and the sulfur content of the charge stock. Initial catalyst cost $20 per barrel of daily capacity, he said.

Estimated operating cost for the plant is less than 12 cents per barrel, Berg said. This is based on operation of the plant by one man.

Pew Given Refining Award

HOUSTON.—Arthur E. Pew, Jr., a director of Sun Oil Co., was awarded a Certificate of Appreciation by the Division of Refining of the A.P.I. at the division's midyear meeting here last week.

Pew was described in the citation as "an able engineer and technologist, a dynamic and enthusiastic administrator, and promoter of the advancing technology of petroleum refining." He was cited particularly for his 15 years as chairman of the division's committee on refinery equipment through which he made "great contributions to the efficiency and progress of the petroleum industry."

The midyear meeting was attended by more than 1,750 registrants. Next year's meeting will be held May 9-14 in St. Louis.

Industry Briefs

BILLINGS, Mont.—James F. Neely has been appointed executive secretary of the Montana Oil & Gas Conservation Commission by T. R. Barnes, acting conservation chairman. Neely, formerly director of World War II Montana Veterans Bonus Commission, succeeds A. B. Gillespie, who has become commission auditor.

REGINA, Sask.—Imperial Oil, Ltd., has taken over permit rights on exploration permit No. 418 on assignment from Gardiner, Low & Morrow. The permit covers 82,320 acres in the Bruno area 42 miles east of Saskatoon and touches on permits held by Imperial.

PIPELINE EXECUTIVES who presided and addressed the American Petroleum Institute's Products Pipeline Conference included, left to right, John W. deGroot, Tuscarora Pipe Line Co., Ltd., Harrisburg, Pa., chairman of the A.P.I. subcommittee on products pipeline technology; E. E. Dischinger, Shell Oil Co., New York, permanent secretary of the subcommittee; J. G. Norton, Magnolia Pipe Line Co., Dallas, moderator of the panel session; S. S. Smith, Shell Oil Co., New York, speaker; and A. J. Helmbrecht, Buckeye Pipe Line Co., New York, symposium presiding officer.

Pipeline Blending

Shell's Smith describes unusual new techniques of mixing 10 gasoline components as product moves through line

Paul Reed

PHILADELPHIA. — How Shell Oil Co. blends gasoline as it moves through a pipeline was described here last week during the fifth annual spring products conference of the Division of Transportation of the American Petroleum Institute.

Other technical subjects discussed during the 2-day meeting included a review of an antirust agent, a report on telemetering and supervisory controls, and a review of Shell's "pipeline meter-prover section." Approximately 400 attended the conference.

S. S. Smith, New York, manager of Shell's products pipeline department, reported on the blending operation. The technique was first applied to pipelining by Smith at installations for Shell's north and east lines. The same type of blender unit is used for loading of tankers and barges.

How it works . . . The technique of blending in the line promises to have far-reaching consequences in products pipeline and refinery practices, Smith declared. He said Shell's pioneer operation blends 10 components in the line through the direction of a computer system developed by Proportioneers, Inc.

These components include light straightrun gasoline, thermal reformed gasoline, catalytic cracked gasoline, polymer gasoline, solutizer, butane, tetraethyl lead, dye, inhibitor, and tri cresyl phosphate.

The computer system operates as a mechanical brain that controls the flow from the storage tanks of each of the components into the line. A memory totalizer reports and compensates for any shortage of products due to an unexpected pumping shut-down of a component movement or of failure in switching base stock storage tanks.

Smith said the control system is completely interlocked with "fail safe" devices to insure delivery of "any product, anywhere, any time."

An 800-ft. calibration loop for meters adjacent to the blender checks the accuracy of each component meter. A measured mile of main line checks the actual volume of blended components and reflects the shrinkage in volume due to absorption of butane in the gasoline.

This blending technique has been widely used in the chemical industry to make synthetic rubber, plastics, and solvents, but Shell pioneered the process in pipelining.

Precision measurement . . . Shell's "pipeline meter-prover section" has indicated during its year of operation at Wood River, Ill., and East Chicago that better accuracy is achieved by calibration at exact operating conditions with no starting and stopping during tests, according to R. E. Speckmann and M. L. Barrett, Jr., both of Shell.

The Shell project is the first of its kind and is considered a step toward the possible use of such equipment for precision pipeline measurement.

These first applications indicate the principle is practicable for high-capacity proving. It has developed possibilities of a system with injection and propulsion of a number of different mechanical devices, chemicals, liquids, and other "plugs" to be detected downstream. There also is the possibility of application of sound wave, electronics, or some other medium for accurate and economical meter proving through a pre-calibrated portion of a pipeline as result of the Shell project.

Corrosion Protection . . . Field experience with an oil-soluble antirust agent has shown that pipelines can be protected indefinitely from corrosion, according to a report by S. Kleinheksel, P. Lawrence, and F. L. Nelson, all of Socony-Vacuum Oil Co., Inc.

The report declared if an antirust agent is added to a product at a certain point, no further addition is needed to protect subsequent distribution facilities.

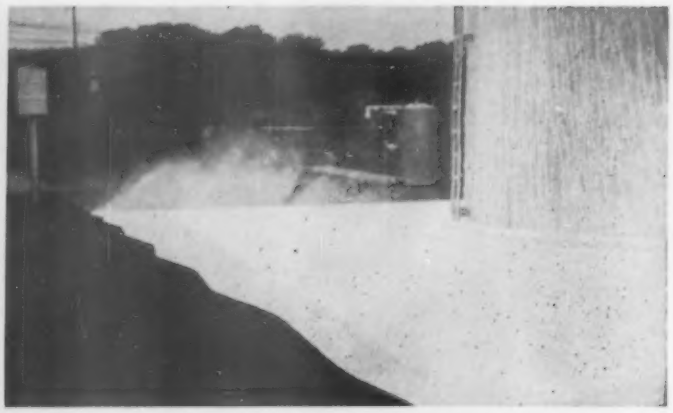
Cleaning, testing lines . . . Twelve years' experience with cleaning and testing was discussed by L. B. Moon, Sinclair Pipe Line Co., with particular attention to practices for converting from crude oil to products service.

In conversion of 460 miles of 8-in. line to products service, Moon said the first 13,200 bbl. of heating oil was pumped into the crude-oil stream and returned to the refinery. Approximately 255,000 bbl. of heating oil had been pumped through the line with several series of scrapers before gasoline was pumped through the line and almost 3,000,000 bbl. of heating oil and gasoline had been pumped through the line before water-white kerosine could be handled without the loss of several numbers in Saybolt color.

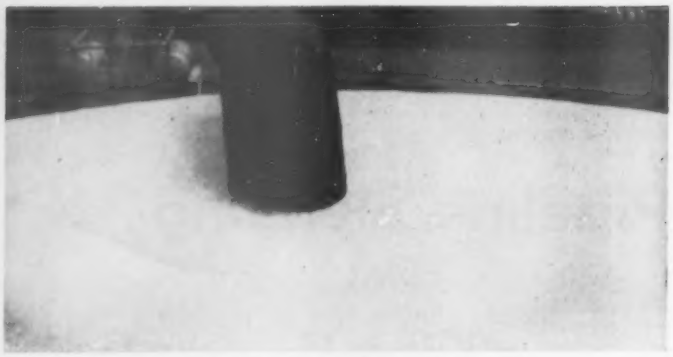
In a recent project where 82 miles of 12-in. crude-oil line was relaid for products service, cleaning and testing were done with water displacement during which it was estimated that 4½ tons of paraffin were taken from the line, he said.

He said it is preferable to displace water with heating oils rather than with lighter products in the cleaning and testing of any line—either new or second hand. The scraper moves easier in heating oils with less wear on the rubbers.

FOAM BLANKETS tank engulfed in flame.



MIXTURE smothers kerosine blaze around tank.



PIPE atop tank applies frothy aerated mixture.

Water-Base Foam Smothers Fire

- New wetting agent foams by aeration, breaks down water surface tension to allow penetration
- One or 2 per cent solution in water returns to liquid state leaving no toxic residue

Bertram F. Linz

INSTITUTE, W. Va.—A new material for fighting oil fires and protecting tank installations, Unox foam, was introduced in a demonstration conducted here by the Carbide & Carbon Chemicals Co.

Although it was developed primarily to meet the fire-protection requirements of the company's own facilities, tests with Unox demonstrated it worked equally well on oil fires and indicated it may be a step forward in fire technology. Within the next few weeks the first installations of Unox will be made by oil companies.

How it works . . . Unox is a wetting agent which breaks down the surface tension of water to permit penetration into surfaces which are normally water repellent. It is turned into foam by aeration. Unlike most foams, which contain some stabilizing ingredient and leave a nonsoluble residue after the water has drained out, it returns to the original liquid state when breakdown occurs, leaving no residue.

As demonstrated before representatives of the National Fire Protection Association, National Board of Fire Underwriters, American Petroleum Institute, and oil chemical fire equipment and fire insurance companies, the action of Unox foam on solids is "three dimensional" as follows:

. . . **Burning material** is blanketed and isolated from air by the foam covering.

. . . **Breakdown into water** is in direct proportion to the heat to which it is exposed affording the most possible application with sufficient cooling action to extinguish the fire.

. . . **Ability to reduce surface** tension of water and high penetrating qualities enable it to extinguish rapidly even on surfaces that are water repellent.

Temperature control . . . The demonstration was made on a 55,000-gal. standard steel tank, set in a 50-ft. square diked area in which 12 in. of water floated 660 gal. of kerosine. A 2 per cent solution of Unox foam was applied through a pipe at the top of the tank, rolling down the side walls in a solid blanket and spreading out over the burning kerosine, which was extinguished in a period of 7 minutes, 26 seconds.

In a more impressive test, kerosine was fed steadily into the burning area for a period of 35 minutes while Unox foam protected the tank with a 1 per cent solution and for a further period of 16 minutes during which a 2 per cent solution was used. In the first period the average temperature of the water in the tank rose 5.3° C. and in the second period another 2.6° C.

In a control test the burning area was kept aflame for 30 minutes with no protection whatever on the tank,

and a temperature rise of 18.5° C. was recorded.

Economy . . . Aside from its qualities of protecting installations and extinguishing fire, Unox foam has the advantage of economy over water spray systems, both in the cost of installation and in a 60 per cent reduction in the amount of water required. It can be used with conventional foam equipment already on the market and can be applied at one point on top of a tank or by Moeller tube, foam chamber and foam maker, or a portable foam nozzle attached to a hand line.

Unox was developed in the course of a 10-year $100,000 research program of the fire research laboratory maintained by Carbide & Carbon Chemicals under the direction of James J. Duggan, with Fred Fisher, his chief assistant, and Walter Baker and Charles Gilmore, project leaders.

The material can be used on practically any type of oil installation, afloat or ashore, Duggan explained, and is suitable for use with either fresh or salt water. The penetrant concentration required is only 1 or 2 per cent by volume, and greater concentrations do not increase the extinguishing or insulating efficiency of the solution. Concentrations in excess of 6 per cent retard its action.

No toxic residue . . . The foam produced by aeration is sufficiently firm to permit the actual building of a "pile" of water on top of a fire. It breaks down into liquid, however, in a matter of minutes, leaving no toxic residues. The foam has about 10 times the volume of the original solution.

Heat-Saving Idea

New catalyst which ignites waste refinery gases can save millions in fuel costs, cut pollution, A.P.I. group told

D. H. Stormont

HOUSTON.—Fuel savings equivalent to millions of barrels of fuel oil can be realized annually in the petroleum industry through application of known methods of salvaging heat contained in refinery waste gases and at the same time atmospheric pollution will be reduced through burning of the objectionable organic materials.

Recent developments which have made possible such important gains in thermal efficiency of catalytic cracking units were reported at the waste disposal session of the A.P.I. refining meeting by D. B. Ardern, Houdry Process Corp., and R. C. Lassiat, Sun Oil Co., both of Philadelphia.

They dealt principally with Sun's experience with a new combustion catalyst, "Oxycat," in fixed-bed units at Sun's Marcus Hook and Toledo refineries. This catalyst, they said, is particularly effective in igniting low concentrations of carbon dioxide and hydrocarbon vapors. Heat recovered from the flue gas then is used in steam generation.

What it does . . . Data presented showed the Oxycat combustion catalyst resulted in 85 to 90 per cent of the carbon monoxide being converted to CO_2. Combined savings realized at both installations was approximately 40,000 bbl. of fuel oil annually. Or, as they further stated, on the basis of fuel oil at $2 per barrel, initial cost of the catalytic heat recovery units was paid out in less than a year.

Based on performance of these units, Oxycat elements are being included for recovering heat from waste gases of two 27,000-bbl. catalytic cracking units being constructed at the two refineries. Each installation will handle about 200,000 lb. per hour of flue gas, with a heat recovery in the order of 50,000,000 B.t.u. per hour. Catalytic heat-recovery facilities also will be included in two additional cat cracking units planned for Marcus Hook, it was disclosed.

A similar installation at the El Paso refinery of Standard Oil Co. of California is demonstrating the effectiveness of Oxycat elements in the correction of an air-pollution problem. Effluent gases at temperatures of 1,400° to 1,600° F. they described as being completely clear in appearance and containing only a trace of carbon dioxide.

Another angle . . . A different approach will be used by Sun at its Toledo plant to recover heat from waste gases of an existing cat cracker. The gases will be directly injected into a furnace fired with auxiliary fuel. Steam will then be produced from the heat released by the flue gases and auxiliary fuel.

The authors said the unit will receive about 150,000 lb. per hour of flue gas, containing approximately 4 per cent carbon monoxide, at 850° F. Auxiliary firing of 10,750 lb. per hour of heavy fuel will result in the production of 190,000 lb. per hour of 500 psig. steam, superheated to 575° F. Heat absorbed from the flue gas will amount to 40,000,000 B.t.u. per hour they added, resulting in a fuel-oil economy of about 60,000 bbl. annually.

Refinery to Close

Socony-Vacuum will shift Olean workers to Ferndale

NEW YORK.—Plans to close down the small and uneconomic refinery at Olean in southwestern New York were disclosed last week by Socony-Vacuum Oil Co., Inc.

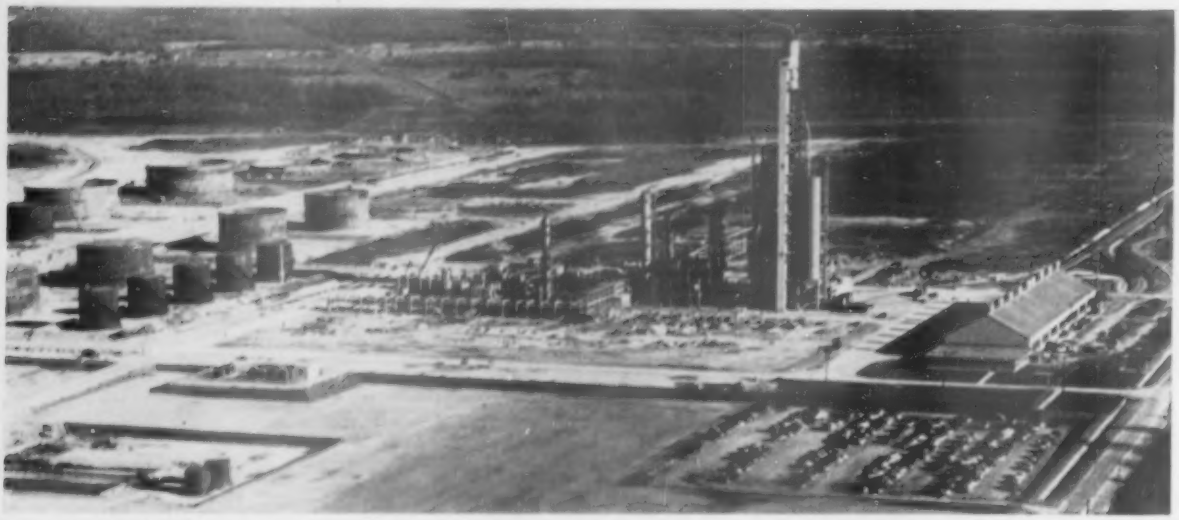
The plant's shutdown will be coordinated with the completion late next fall of the new 35,000-bbl. daily Ferndale, Wash., refinery of General Petroleum Corp., a Socony-Vacuum affiliate. This will allow a transfer of a substantial number of the 346 Olean employes to the Pacific Northwest.

The Olean refinery has a capacity of about 6,500 bbl. daily. It comprises skimming facilities and equipment which can produce around 1,200 bbl. daily of lubricating oil. The refinery is one of the oldest in the industry, having begun operations in 1876. It is located on 114 acres in the northwestern part of Olean, about 18 miles northeast of Bradford, Pa.

Runs decreasing . . . The Olean refinery has recently been processing only 2,500 to 3,000 bbl. daily and further decreases in runs are in prospect as a result of further declines in production in the Pennsylvania and New York fields. George S. Dunham, Socony-Vacuum director in charge of manufacturing, said additional crude could be brought in, but Olean's location with respect to consuming markets would make such an operation uneconomic.

Socony-Vacuum is now taking preliminary steps for the eventual complete shutdown. Dunham said efforts would be made to sell the properties to some industrial enterprise. He said the company was trying to close down its operations in such a way to cause the least possible dislocation to the economic life of the community.

Socony-Vacuum is offering jobs at Ferndale or one of the company's other refineries to all physically qualified Olean employes. Only exceptions are those for whom special retirement or termination arrangements will be made on account of age or physical disabilities. Employes within 6 years of normal or optional retirement will be offered accelerated retirement. Of the 346 Olean employes, 79 are eligible for this accelerated retirement.



FORMAL OPENING ceremonies were held last week at the new refinery of Sun Oil Co., Ltd., at Sarnia, Ont.

Sun Opens New Plant

Many modern processing ideas found in Sarnia refinery; four sewer systems, underground storage among features

SARNIA, Ont. — Canada's latest brand-new refinery was officially opened here May 15 by government officials and representatives of Sun Oil Co., Ltd.

The new 15,000-bbl. per day Sun plant is located on the international St. Clair River in what has come to be known as Canada's "Chemical Valley." Like the other petroleum processing facilities in the nation's second largest refining center, the Sun refinery provides its share of petrochemical raw materials to the growing industry.

For the present, at least, the refinery will process U.S. crude.

It is a specialized fuels plant, producing one grade of gasoline, kerosine, No. 2 fuel, heavy fuel oil, and light hydrocarbons. The only nonfuel product is the light hydrocarbon fraction processed by neighboring Polymer Corp., Ltd., for synthetic rubber and other petrochemical manufacture.

Modern process design . . . The modern combination concept of process design is incorporated in the new refinery. The central "combination" unit consists of the crude unit, the atmospheric flash unit, a Houdriflow catalytic cracking unit with its synthetic tower, a compressor and contactor section, a debutanizer and distillate treating and tetraethyl lead blending facilities. Also included is a Houdriforming unit with its associated depropanizer.

Although design yields of the various fuel products are not revealed, the refinery should produce a high percentage of gasoline and burning oil, with catalytic cracking capacity (including recycle) representing 77 per cent of crude capacity. The catalytic reforming unit is also sized big—at 20 per cent of crude capacity, and it is operating exclusively for octane.

How it works . . . By means of exchange with four processing streams, the crude is heated to a heater inlet temperature of 425° F. Light hydrocarbon liquids and wet gas from the crude tower and the synthetic tower operating with the Houdriflow unit are moved to the Polymer Corp., which separates out butanes and heavier and returns dry gas to the refinery for fuel.

A light straightrun gasoline is withdrawn from the crude tower for blending to finished product. The straightrun naphtha fraction is catalytically reformed. Straightrun kerosine is treated for distillate fuel blending. The atmospheric gas-oil stream from the crude

ALL INSTRUMENTS of Sun's new Sarnia plant are located on panel boards located in one central control house. With exception of the multipoint temperature recorders, all instruments are of the miniature variety which permits a substantial saving in panel board space.

tower is charged as liquid feed to the Houdriflow unit together with catalytic recycle from the synthetic tower. The crude tower bottoms fraction is charged to the reduced crude heater, and an additional distillate fraction, recovered from the atmospheric flash tower, goes direct to the Houdriflow unit as vapor feed.

Elaborate sewer setup . . . In accordance with the latest thinking on pollution abatement, the refinery is designed with three segregated sewer systems—a storm sewer, a contaminated sewer, and a process sewer. An additional open storm sewer serving the nonprocessing area of the refinery returns uncontaminated surface run-off directly to the river. Each of the other systems has its own A.P.I. gravity separator.

Of particular interest to the industry is the biological oxidation pit for bacterial consumption of phenols in waste water. A diked area close to the separators is used for this pit. A portion of this area—on the end—was deepened, the excavated earth being used for the fourth wall of the pit. An aerating system was installed consisting of a blower, pumps, and eductor mixers. The overflow from the pit goes to a section of the contaminated separator which was isolated from the remainder of that separator. Necessary pumps were installed to recirculate a portion of the clear effluent for dilution as well as to return the biological sludge to the oxidation pit.

The system operates as follows:

. . . **Drainage** from the process sewer passes through the process separator where oil is removed.

. . . **Overflow** from the process separator joins a portion of the biologically treated effluent and passes to the bio-pit. The proportions are adjusted to give 50 to 100 p.p.m. of phenols in the feed to the bio-pit. Air from a positive pressure blower and biological sludge are added.

. . . **Overflow** from the bio-pit flows into the separator where the sludge settles out. The net clear overflow goes to the outfall sewer where it is diluted with the rest of the refinery waste water.

Underground caverns . . . Among the many unique features of the refinery are the use of underground salt caverns for working storage of light hydrocarbons. The company has dissolved three caverns of the conventional type from the salt beds underlying the refinery. One was developed at a depth of 2,650 ft. and the other two are 2,300 ft. deep.

One 30,000-bbl. cavern or "well" is used for contaminated butanes-butylenes which are received by pipe line from Sun's Toledo refinery. One of two 50,000-bbl. "wells" is held on standby to receive these light hydrocarbons when Polymer Corp.'s processing facilities are shut down. The third cavern, also of 50,000-bbl. capacity, is the butane well. It receives butane plus pentanes and heavier recovered from refinery units and returned by Polymer Corp.

All caverns are kept liquid full at all times by injecting or withdrawing saturated brine to displace hydrocarbons. A large earthen brine storage pit with a capacity of 90,000 bbl. is maintained at the refinery for this purpose.

Williston Strike

Light gravity crude taken from Saskatchewan wildcat

REGINA, Sask.—Canadian Gulf Oil Co. has promise of commercial production in southeastern Saskatchewan.

A wildcat located 19 miles east of another discovery well has recovered a sizable amount of light gravity crude from the Mississippian section. Recovery in the second of two tests, conducted in a 20-ft. section in the top of the Mission Canyon, was reported as 2,900-ft. of free 32°-gravity oil with about 4 per cent connate salt water.

The well is the second wildcat discovery made by Gulf in the Saskatchewan section of the Williston basin in the past 2 months.

The latest wildcat is 1 mile southwest of Glen Ewen, 7 miles east and 1 mile south of Oxbow, 28 miles west of the Manitoba border, and 14 miles north of the North Dakota border. The well is in a permit covering 82,692 acres and farmed out by Gulf from Calvan Consolidated Oil & Gas Co., Ltd. Canadian Gulf holds 75 per cent interest in the permit and Calvan the remainder.

Other companies holding freehold acreage within a mile of the strike include Imperial Oil, Ltd., Bailey Selburn Oil & Gas, Ltd., and Cordillera Petroleums of Canada, Ltd.

Under the farmout agreement, Gulf is committed to two wells on the permit, including one Lodgepole and one pre-Cambrian test. This is the first of the two ventures. Arrow Drilling Co., Tulsa, is drilling contractor.

"Personals" Moved

THE Journal's popular "Personals" pages have been moved to another section of the magazine.

They will now be found between the "Exploration" section and the Journal's "Statistics" pages—in this issue beginning on page 189.

The change was made for two important reasons: To permit expansion of the Journal's coverage of industry news, and to permit better presentation of the technical articles.

The shift means that you will get more pages in the "News" section each week. It also means that you will get a greatly increased number of consecutive editorial pages in the "Engineering-Operating" section. We have taken the step to make the Journal more valuable to you and more readable. We hope you like it.

Production Tax Scheduled

WINNIPEG.—Effective in Manitoba's current fiscal year, owners of producing crude oil wells will pay a mineral tax of 8 mills annually on an assessed value based on the production for the previous calendar year. This legislation, the Mineral Taxation Act, was passed by the Manitoba legislature March 26.

The tax applies only to crude oil under land which has been defined as a producing area.

Although the assessment is made on the mineral rights owner, the lessee will normally pay its pro rata share of tax under the terms of the normal mineral lease, while the land owner will stand the cost of the tax on his royalty interest. No direct assessment is made on the lessee *(The Oil and Gas Journal, March 29, page 63)*.

The annual assessment will be made before August 1.

Newcomer In Saskatchewan

REGINA, Sask.—The Saskatchewan Department of Mineral Resources has issued exploration permits covering 1,597,600 acres in the north half of the province to three companies, including more than a million acres to Stanolind Oil & Gas Co., Tulsa, a newcomer to the province.

Stanolind has taken out 1,297,600 acres in a diagonal northwest-southeast tract running from the Birch Lake region 78 miles east of Lloydminster to the Pierceland area on the Alberta border 72 miles north of Lloydminster.

Hudson's Bay Oil & Gas, Ltd., has been granted permits covering 200,000 acres in the Arelee-Asquith region, 33 miles west of Saskatoon. The new acreage is contained between Townships 36 to 38 and Ranges 8 to 12, inclusive, west of the third meridian.

J. W. MacKenzie Drilling, Ltd., of

Saskatoon, has been granted exploration rights on 100,000 acres in the Paradise Hill area centering on a point about 30 miles northeast of Lloydminster.

Manitoba Tie-Up

Thaws, road dispute halt oil activity in Manitoba

VIRDEN, Man.—Virtually all oil activity in Manitoba has been at a standstill for about 3 weeks because of a dispute between two rural municipalities and the provincial government over increased financial assistance for maintaining secondary highways and side roads, soft because of thawing.

Wallace and Pipestone municipalities (counties), in which Daly and Roselia fields are located, may refuse to lift the annual road-protection restrictions until the provincial government agrees to make extra payments for road construction and maintenance.

The municipalities asked the provincial government for help in road financing more than 6 weeks ago, but "no satisfaction has been obtained." The request was to allow Wallace and Pipestone to assess well sites, drilling equipment and pipelines or to receive a percentage of the new tax now imposed on crude oil. The tax is about 3 cents per barrel.

Contributions for road work have been made in past years by oil companies, but they do not intend to continue this because they believe the crude-oil tax should make outside funds unnecessary.

Gas Production Found

REGINA.—The possibility of natural-gas production is indicated in a new and third zone in a field development well being drilled by Bata Petroleums, Ltd., in the End Lake gas field in west-central Saskatchewan.

In a 99-minute drill-stem test of the top of the Blairmore section, the well gave up natural gas at the rate of 606,000 cu. ft. a day.

Two previous tests conducted in the well also gave up natural gas in sizable quantities. Gas rose to the surface in ½ minute in a test of the Unity sands interval 2,082 ft. to 2,103 ft., and flowed at the measured rate of 3,780,000 cu. ft. a day through a ⅝-in. choke. The valve was open 116 minutes and shut in for 30 minutes.

The first test in the well was conducted in the Viking sands in the interval 1,662-89 ft. The valve was open for 104 minutes, shut in 34 minutes and open flow rate was 1,300,000 cu. ft. a day.

The well is Bata Petroleums No. B-3-24, located in LSD 3, 24-39-23w3, ⅜ mile northeast of the Bata No. 7 gas well and ½ mile south of the Bata No. 2 shut-in venture and some 5½ miles southwest of Unity. The well was drilled to a total depth of 2,103 ft. and 7-in. production casing set at 2,095 ft.

Lube Plant Opens

MONTREAL.—Canadian Oil Companies, Ltd., has gone on stream with the first plant in Canada using an oil homogenizer in the blending of various oil mixtures.

The $2,000,000 lubricating plant replaces the firm's old plant which was destroyed by fire last year. The plant, located in Montreal East, is equipped to fill 300 1-gal. cans a minute.

ROCKY MOUNTAIN

Line Bid Is Surprise

Northern Natural files unexpected offer to build North Dakota gas line; opposes North Dakota Natural proposal

BISMARCK, N. D.—Northern Natural Gas Co. has offered to build a North Dakota gas pipeline.

The Omaha company filed a surprise, last-minute brief with the Public Service Commission arguing that North Dakota Natural Gas Transmission Co. had failed to make a case in its application to build and operate a pipeline from the Tioga natural-gasoline plant of Signal Oil & Gas Co. to Fargo and Grand Forks in eastern North Dakota.

Northern Natural has a dormant application with the Federal Power Commission to build 400 miles of 24-in. line from the Canadian border to tie in with its system at Minneapolis-St. Paul if Alberta gas is available for export. The proposed line would extend south from Winnipeg, Man., past Grand Forks and Fargo, N. D., two key anchor cities in North Dakota Natural's plan.

Obstacles overcome . . . "Within the last few months most of the obstacles to the export of Canadian gas from Alberta have been overcome," Northern Natural's brief said, adding that a final decision was expected in a few weeks.

The company said, "We have in mind the prospect of changing the routing of our proposed pipeline out of Canada to move the point of delivery from a point south of Winnipeg to the border north of the Tioga field."

"Northern Natural Gas Co. would then propose to build a 500-mile, 24 or 30-in. pipeline across North Dakota from Tioga past Minot to Fargo and from there eastward to the Twin Cities."

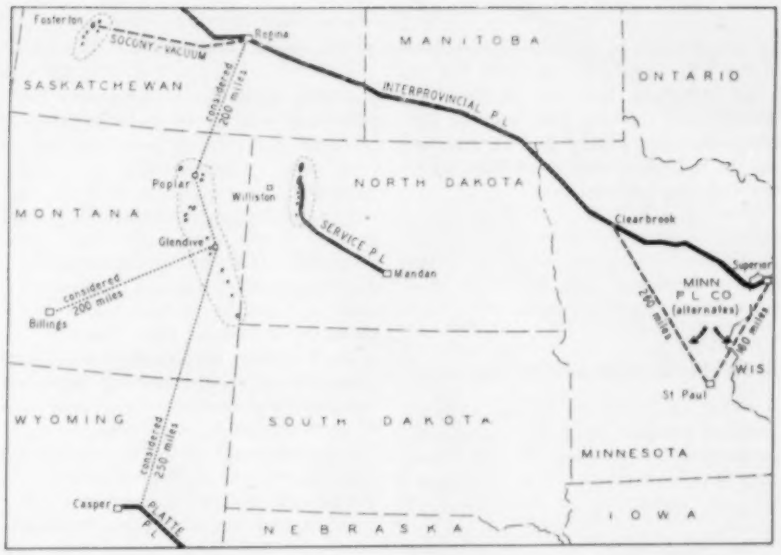
"Northern Natural Gas Co. would be willing to construct any reasonable branch lines from any such main line to serve North Dakota cities and towns including Grand Forks."

The Omaha company said that if the urgencies of the natural-gas situation in North Dakota are such that the only reasonable solution to the present problem is the immediate construction of a pipeline this year, Northern Natural Gas Co. would be willing to build a 24-in. pipeline from the Tioga field to the Grand Forks-Fargo area this year.

Owned by Amerada . . . Northern Natural was one of the unsuccessful bidders for the dry gas owned by Amerada Petroleum Corp., chief operator in Beaver Lodge and Tioga fields. There have been hints that the state will forbid continued flaring of gas if a market is not obtained this year. Northern Natural's plan would hinge upon a denial of a certificate to North Dakota Natural, cancellation of Amerada's contract with North Dakota Natural, and the successful negotiation of a contract by Northern Natural with Amerada.

Northern Natural was represented at the hearings which began February 2 but entered no evidence to oppose North Dakota Natural's application. The only opposition entered in evidence was that of North Dakota lignite coal operators and miners, supported by the National Coal Association and railroads operating in the state.

The Northern Natural brief asserted North Dakota Natural's plan does not provide an adequate market, an adequate and reasonably priced natural-gas supply and says the proposed pipeline is of "uneconomically small size" for "any substantial additional volumes of gas from such lines if additional markets were available."



Sioux Line Shelved

Participants decide against plan for big Williston basin pipeline and turn to plans for individual line projects

Henry D. Ralph

A BOLD plan for a big-inch pipeline to carry Montana crude oil to eastern markets in the Great Lakes area has been dropped as not economically feasible at this time.

Instead, the individual participants in the preliminary studies are turning to a variety of proposals for providing market outlets for the growing producing capacity of the western half of the Williston basin, now largely shut in.

The big project, dubbed the Sioux Pipe Line System for purposes of identification, was a cooperative planning effort by 12 companies with producing interests in the Williston basin. Shell Pipe Line Corp. spent months making a detailed economic and engineering survey, and its report is now in the hands of the participating companies.

The Sioux line was projected as about 24 in. in diameter, originating at a gathering point somewhere in the Poplar-Glendive trend of fields in eastern Montana, running some 600 miles east to St. Paul, Minn., and southeast another 400 miles to Chicago *(The Oil and Gas Journal, September 21, 1953, page 152)*. It is understood that the Shell report concluded that such a line would not be economic at present.

A second section of the Shell study covered a number of other possible pipeline and refinery projects for providing a market for crude in this area, and all these possibilities are now being considered intensively by the individual companies concerned.

The first of these projects to be built undoubtedly will be for the purpose of moving crude from the Fosterton area of Saskatchewan, on the extreme northwest edge of the Williston basin, to St. Paul, Minn., to serve the refinery now being constructed there by Great Northern Oil Co. This crude will move via the Interprovincial Pipe Line Co. and two new lines which probably will be started this summer:

... **Socony-Vacuum Exploration Co., Inc.,** will build from the Fosterton area to Regina, Sask., to connect with Interprovincial, a common-carrier line taking Alberta crude to refineries in Sarnia, Ont., across Minnesota, Wisconsin, and Michigan. Since Fosterton crude has a gravity of about 24° it will be batched to segregate it from the high-gravity Redwater stream.

... **Minnesota Pipe Line Co.** will build a line from St. Paul to a take-off point on Interprovincial, either at the Clearbrook pump station in northern Minnesota or the original terminus of Interprovincial at Superior, Wis. This company was recently formed by Woodley Petroleum Co., Houston, which is the principal owner of Great Northern Oil Co.; Woodley, Socony-Vacuum, and Southern Production Co. all have crude production in the Fosterton area, and Socony has contracted to deliver 20,000 bbl. per day of Fosterton crude to Great Northern by the time the refinery is completed, probably late in the summer of 1955.

These three companies participated in the Sioux project, presumably with the idea of moving Fosterton crude into Montana to link up with the big-inch line running east, but they have now decided that they cannot wait until the Sioux line becomes practical and that their own interests will be better served by building their own lines. It is understood that it will cost them somewhat more per barrel to move the crude via Interprovincial but their capital investment will be far less than if they had joined in building the Sioux line.

With these three companies out, the Sioux line looked even less promising to the remaining participants, and each one is now studying alternate suggestions. The remaining companies in the Sioux group are Murphy Corp., Columbian Carbon Co., Atlantic Refining Co., Northern Pacific Railway Co., Ohio Oil Co., Placid Oil Co., Shell Oil Co., Tide Water Associated Oil Co., and The Texas Co.

At least three other pipeline projects are among the alternate plans covered in the Shell study. None of these would be nearly as large in capacity as the Sioux proposal, but they would originate somewhere in the Poplar-Glendive region and run:

... **West to Billings** and Laurel, Mont., a distance of about 200 miles, where there are three refineries running on Wyoming crude.

... **South some 250 miles** to near Casper, Wyo., to feed into the Platte Pipe Line running to Wood River, Ill.

... **North about 250 miles** to Regina, Sask., where Interprovincial would be asked to move the crude in customs bond to some take-off point in the United States, presumably eastern Michigan.

Some of the producers in eastern Montana are also making market studies of the outlook for a refinery somewhere in that region or in western North Dakota. Among these are Murphy Corp. and Placid Oil Co. (an H. L. Hunt interest), which have a large producing capacity in East Poplar field without market outlets except by long rail hauls. To date, however, these surveys are purely exploratory and there are no definite plans to build either a refinery or one of the several pipelines.

The Socony-Woodley group had placed a deadline of May 1 on their decision regarding the Sioux project because of the necessity to begin construction on one route or the other this summer in order to supply the Great Northern refinery by August 1955.

England To Get Plant

U.O.P., British firm to join in building catalyst works

WASHINGTON.—Universal Oil Products will invest $750,000 in cash and technical know-how to produce platinum catalyst in England under a guaranty program designed to encourage a build-up of the European economy.

Universal, in partnership with the British firm of Johnson Matthey & Co., refiners of precious metals, will establish a subsidiary, Universal - Matthey Products, Ltd., to build a plant in England to produce catalyst used in the UOP Platforming process. The catalyst will be distributed in England, France, and Germany.

The plant will be constructed under a guaranty issued by the United States' Foreign Operations Administration. Under a FOA contract, a firm may invoke the guaranty if it is unable to convert sterling receipts from its investment into dollars through regular foreign exchange channels. The U. S. Government will provide dollars in exchange for the sterling—up to a limit of the guaranty—during the life of the contract.

The guaranty, announced last week by the FOA, was approved by the United Kingdom Government. It is the sixth granted an oil company for investments in Europe.

FOA explained the project will make four principal contributions to European economic strength. They are:

... **Providing** an assured source of catalyst to the sterling area, saving the British economy several million dollars annually.

... **Adding** to England's dollar resources through the expenditure of cash by UOP for the plant.

... **Increasing** England's foreign currency income through the sale of the catalyst in Germany and France.

... **Enabling** refiners using the process to produce high-grade toluenes that now are in short supply in Europe.

I.R.A.A. Takes Import Action

WASHINGTON.—The Department of Justice was asked last week to approve joint voluntary action by oil companies to reduce imports.

M. H. Robineau, president of the Independent Refiners Association of America, disclosed he has asked the association's Washington attorneys to write Attorney General Herbert E. Brownell, Jr., asking him whether the companies can legally join in discussing the voluntary import problem without violating antitrust laws.

The I.R.A.A. will not support quota legislation as suggested by the coal industry and some segments of the oil industry, Robineau said, but will press for voluntary cuts in imports.

New Hydrogenation Process

WASHINGTON. — A new hydrogenation process which will permit the production of gasoline directly from coal is being worked out at the Bruceton, Pa., laboratory of the Bureau of Mines.

In a report to Congress on synthetic liquid fuels research, Interior Secretary Douglas McKay disclosed that a pilot plant is being modified to explore the practical aspects of the new single-step method which engineers believe may replace the present two-step process.

Work on the new method was one of a number of projects carried on by the bureau at Bruceton, Rifle, Colo.; Laramie, Wyo.; and Morgantown, W. Va., in the development of liquid fuels and chemicals from coal and oil shale.

Since last June, when the coal-to-oil demonstration plants at Louisiana, Mo., and the underground-gasification experiments on coal at Gorgas, Ala., were discontinued, the bureau has been emphasizing fundamental laboratory and pilot-plant studies to improve known processes and develop new ones.

A new gas-combustion retort has been put into operation at Rifle. In five runs totaling 20 days, the retort handled 2,240 tons of raw shale and produced 1,075 bbl. of oil, results indicating that a reasonable oil yield and shale rate can be attained after certain operating techniques are improved.

At Laramie, high-quality oils were produced at rapid retorting rates by heating oil-shale fines (particles less than ¼ in. in size) entrained in gas. The report stated that oils produced by this process are highly aromatic and are possible sources of premium-quality gasoline and chemical raw materials.

Alaskan Data Released

WASHINGTON.—Geologic reports and technical data accumulated during the Navy's 10-year search for oil in Alaska, have been made available for inspection at the Geological Survey offices in Washington and the office of the Inspector, Naval Petroleum Reserve No. 4, at Fairbanks, Alaska.

A series of reports presenting the results of the exploration program are now being prepared for publication, but the basic material is being made available now because of current interest in the petroleum and natural gas possibilities of northern Alaska.

Indiana Standard Erects Huge Hydroformer Reactor

Standard Oil Co. (Ind.) will operate one of the largest and heaviest reactors ever built when it finishes its present expansion at its 220,000-bbl. Whiting, Ind., refinery. The reactor, being fabricated in the Jersey City shops of its designer, M. W. Kellogg Co., will tower more than 200 ft. high and weigh more than 1,300,000 lb. The unit will form the heart of the 30,000-bbl. Hydroformer which Standard is building at Whiting.

The technical data available for inspection include geologic reports, photogeology maps of a large part of northern Alaska, and reports on the Gubic gas field and the Umiat oil field discovered by the Navy.

Gas Lines Opposed

Pacific Northwest, West Coast proposals draw fire

WASHINGTON. — Federal Power Commission attorneys recommended last week that neither the Pacific Northwest Pipeline Corp. nor the West Coast Transmission Co. be granted a certificate for a natural-gas pipeline to serve the Pacific Northwest area.

The commission recently suspended hearings in the matter to consider whether the applicants made a proper showing of gas reserves adequate to support their projects. Staff counsel held they had not.

Neither company, counsel said, has presented a complete proposal upon which a determination can be made.

The applications to bring gas to the northwestern area have been before the commission 2 years, during which 192 days of hearings have been held on Pacific Northwest's proposal to transport gas from the San Juan basin. *(For activity in San Juan basin as result of Pacific Northwest's proposed line, see page 170 of this issue.)*

The West Coast project contemplates transporting Canadian gas, which would involve a permit for its importation. Considerable opposition has been expressed to the importation of foreign gas. A bill requiring the FPC to consider such proposals in the light of possible injury to competing domestic fuels is pending in Congress.

Land Offices Opening

WASHINGTON.—The first of the area offices of the Bureau of Land Management are now being opened in Portland, Ore., Salt Lake City, and Denver. They will replace six regional offices formerly operated in those areas.

The Portland office will be headed by James F. Doyle, formerly assistant regional administrator there, with M. J. Pike as staff officer for lands and materials.

The Salt Lake City office head will be H. Byron Mock, formerly regional administrator, with H. J. Van Der Veer as lands and minerals staff officer.

At Denver, Westel B. Wallace, formerly administrator at Billings, Mont., will be administrator, with H. T. Tysk as lands and minerals staff officer.

WATCHING WASHINGTON

Bertram F. Linz

Coal's Chances Slight

The bituminous coal industry has an ambitious program for increasing production by 50,000,000 tons a year, largely at the expense of oil and gas.

Industry representatives recently laid their plans before Felix E. Wormser, Assistant Secretary of the Interior, asserting that much of them could be carried out without legislation.

All the coal industry wants is a limitation on imports of Canadian natural gas, more complete refining of oil processed abroad to reduce the amount of residual fuel for export to this country, divorce of pipeline companies from natural-gas production, protection of coal from "excessive" natural-gas competition, and greater use of coal in government installations.

Interior officials are sympathetic to the coal industry, but they have equal obligation to the oil and gas industries. It is doubtful they will find it possible to go along with these recommendations.

U. S. Now in Business

The Government is in business in the outer Continental Shelf after years of stalemate.

Sometime this summer the Interior Department will ask interested oil operators to nominate the tracts to be offered for lease and bids will be opened early next fall. Officials anticipate bonus bids equal to the large sums offered for Louisiana tideland leases.

It is expected a "twilight" zone will be set up between the state lands and those offered for Government lease pending settlement of two issues. The department probably will confine its early leasing activities to areas beyond the 12-mile mark, leaving a belt 1½ miles wide beyond the Texas state border and 9 miles beyond the Louisiana line.

One issue has been raised by the fact that, as now surveyed, the outermost tracts in the Texas tideland jut into the federal territory and the adjoining federal tracts have points inside the Texas border.

The second issue has been raised by Louisiana, which is now claiming a 3-league border in the gulf rather than the 3 miles provided in last year's act returning the tidelands to the states.

FPC Looks at Escalation

The Federal Power Commission last month liberalized its policy to permit pipeline companies to value their own natural-gas production at field prices but next September it plans to tighten up in another field—that of automatic escalation and "favored nation" clauses in purchase contracts.

Some of the natural gas transported by the pipeline companies is purchased from producing and gathering companies under contracts providing for automatic increases in price whenever the pipelines are permitted to increase their wholesale rates or whenever certain index figures are raised. The "favored nation" clause calls for an increase in the price paid a producer by the pipeline if it or any other producer in the same field receives higher prices from any transporter or if a bona fide offer to purchase gas has been made to a producer within the defined area.

The commission believes it is generally desirable that the pipelines make long-term contracts for their supply, but that contract provisions which are not in the public interest should not be approved merely for the purpose of extending the reserve contract period.

The commission plans to make an investigation to determine whether automatic escalation, favored-nation or other contract provisions have any reasonable relation to the economics of producing, gathering or transporting natural gas. It will look at the possibility of regulating them without violating the exemption granted in the Natural Gas Act to the production or gathering of gas.

Over the past few years, as pressure for increased gas prices intensified, the commission has become increasingly concerned over the effect of the automatic price-rise provisions in many of the contracts under which pipeline companies secure their supply. The issue is involved in certificate applications now before it, and officials feel the time has come to deal decisively with the problem.

Mud Plugs Horizons

Permeability of sandstone reservoirs reduced permanently by drilling fluid, Pacific Coast district of A.P.I. is told

LOS ANGELES. — Permeability of sandstone oil reservoirs can be materially and permanently reduced by particles of drilling mud seeping into the horizon, two Union Oil Co. researchers have concluded from tests carried out at the company's laboratories here.

The two investigators, R. F. Krueger and L. C. Vogel, reported on their laboratory work at the spring meeting of the American Petroleum Institute's Pacific district, held here May 6-7.

They studied the effects of several typical drilling fluids on water insensitive sandstone cores, 1 in. by 12 in. long. The dynamic, high-pressure, high-temperature conditions simulated those existing in the drilling of deep wells. They found that particles from all fluids penetrated into the interstices of the cores, producing a permanent impairment of permeability which increased in magnitude directly with exposure time.

They further found that under the experimental conditions, "the advantage to the use of an oil-base drilling fluid apparently lies in its inherently lower fluid loss to the formation."

Test results . . . Other conclusions reached in regard to particle damage were:

. . . Permeability damage of a core so treated increased with time of exposure to the drilling fluid.

. . . Different types of fluid caused different degrees of damage in a core for a given exposure time, but different samples of the same type produced about the same damage even though from dissimilar drilling environments.

. . . Cores subjected to circulating mud alone were damaged less than cores which had the mud continually scraped from the core face during circulation.

. . . Data from all cores plotted on a single graph of ultimate recovery of permeability vs. fluid loss revealed the degree of damage was independent of the type of drilling fluid and test conditions, and was related only to the total amount of filtrate (and the attendant particles) which had passed into the core.

. . . Qualitative data indicated that particle damage extended about 2 in. into a core exposed to the oil-base drilling fluid for 5 days and about 6 to 12 in. or more into a core exposed to clay-water base and emulsion drilling fluids for the same length of time.

More conclusions . . . A theoretical consideration of the significance of these results in a radial system resulted in the following tentative conclusions:

"The laboratory data tend to yield results in regard to the degree of damage slightly more pessimistic than should be expected in the field.

"For sandstone in which water sensitivity and water blocking are not important factors, all five drilling fluids tested appear to cause approximately the same reduction in productivity. For a 5-day exposure to circulation and scraping conditions, the reduction in productivity was calculated to be approximately 15 per cent and for a 30-day exposure approximately 30 per cent.

"It would appear that damage from fresh water filtrates in water sensitive formations is in many cases more severe than particle damage in an inert formation, but the latter does seem to be significant when completion times extend from 20 to 30 days or more.

"For long mud exposure times, it appears to be advantageous because of the apparent small depth of penetration of the particle damage to complete a well with oil-base drilling fluid, even in nonwater sensitive zones. Calculations indicate that it may be possible to underream the bore hole sufficiently and rapidly enough to achieve a productivity approximately 20 per cent greater than that for a water-base or emulsion-drilling fluid completion."

Inhibitors Effective

A.P.I.'s Pacific district told chemical inhibitors show 51 per cent reduction in repairs on California pumpers

LOS ANGELES. — Chemical inhibitors have proved by far the most effective means of mitigating corrosion in California pumping wells, where only small losses of metal may result in unusually high repair costs, members of the American Petroleum Institute's Pacific Coast district were told at their annual spring meeting here May 6-7.

Because of the success of corrosion control programs, which a survey showed resulted in a 51 per cent reduction in repair jobs, "We can confidently look forward to a significant savings in operating costs," P. W. Hill of Signal Oil & Gas Co. and F. E. Davie of Shell Oil Co. concluded.

Labeling earlier electrical, alkali neutralization, and mechanical "gadget" methods as largely ineffective, they said successful approaches have been through use of alloys, coatings, and inhibitors. Of the three, the latter have been the most effective.

The authors stressed that response to inhibitors varies . . . "some wells seem to defy even the otherwise most effective treatment . . ." They added that selection is by trial. No practical criteria for predetermination of field performance has been developed.

Two general types of chemicals have proved successful in California:

. . . Inorganic, as represented by chromates and arsenical compounds.

. . . Organic types, which are high molecular weight, semipolar compounds usually containing nitrogen.

Survey results . . . The results of a survey of 340 pumping wells in 17 California fields were discussed as follows:

"The average well was found to be producing 29 bbl. of oil per day and 193 bbl. of water per day for an 87 per cent water percentage or cut. The average depth was 3,850 ft. and the hydraulic horsepower, 6.3. Of the inhibitors used, 65 per cent were classed as inorganic and the balance as organic. The iron count showed a reduction of 80 per cent. The average period reported before treatment was 22.2 months, and after treatment was 21.1 months.

"The most significant figures were the total number of pulling jobs before treatment, or 8.6 jobs per well per year, compared with 4.2 jobs after treatment. This is a reduction of 51 per cent.

"The number of tubing failures before treatment reported as 3.1 per well per year was slightly less than the num-

ber of rod failures or 3.5 per well per year, but the reduction of failures after treatment was greater for the tubing (71 per cent) than the rods (66 per cent). Since tubing repair jobs generally cost considerably more than rod jobs, the saving on tubing jobs should be emphasized.

"The cost of inhibitor treatment varied widely according to the survey, but averaged above $30 per month per well. In order to get some idea of the economic benefits, the labor cost of tubing jobs may be roughly estimated at $200 and rod jobs at $100 each. On this basis the saving in labor cost alone, due to treatment would be about $300 per well per year. To this can be added the value of the reported saving in material, 12 joints of tubing and 12 rods per year. Indirect benefits, such as reduction of down time, are also appreciable."

Utilities' Gas Supply

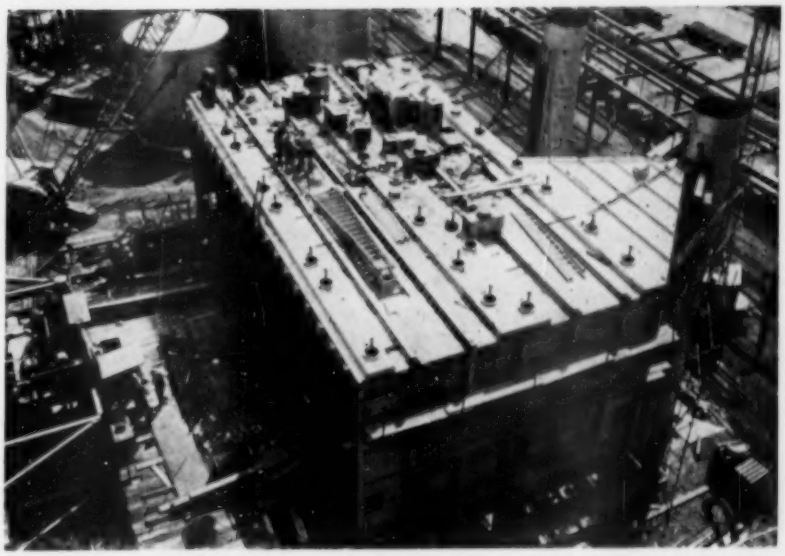
California's reserves set at five trillion cubic feet

SAN FRANCISCO. — California's pipeline reserves of natural gas for consumer use total about 5 trillion feet, Roy M. Bauer, gas operations engineer for Southern California Gas Co. and Southern Counties Gas Co., estimated here during a meeting of the technical section of the Pacific Coast Gas Association.

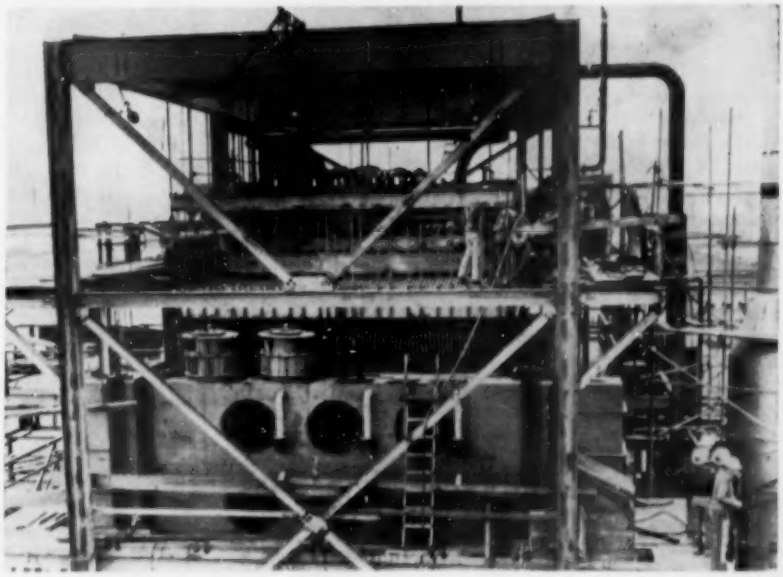
Bauer said these reserves represent approximately 55 per cent of the recoverable residue reserves for the state. His estimate was made for December 31, 1953. These reserves include about 85 per cent of the total dry gas reserves, or about 2 trillion cubic feet, and 45 per cent of the total oil well gas reserves, or about 3 trillion cubic feet.

In making an estimate of gas reserves available to utility companies for use by their consumers, Bauer said he considered the requirements of producers for exploratory and field development purposes, absorption plant operations, oil refinery operations, and petrochemical operations. The estimate excludes all oil and gas operators' requirements.

He said California's ultimate recovery—past production plus present recoverable reserves — is estimated at about 23 trillion cubic feet, with approximately 20 per cent of this being dry gas and the remainder oil-well gas. About half of the state's gas reserves are found in the South San Joaquin Valley area and the remaining half evenly divided in the North-Central California and the Coastal and Los Angels basin areas, he said.



Richfield Spends $6 Million



In Refinery Fight With Smog

LOS ANGELES.—Richfield Oil Corp. has spent $6,737,431 on devices to suppress smog in connection with its $40,000,000 expansion program at its Watson refinery near Los Angeles Harbor.

The refinery's stacks are equipped with electronic indicators to detect smoke and sound an alarm and "almost fantastic" precautions have been taken to prevent the loss of catalyst to the atmosphere from cat crackers.

Included in the mammoth smog expenditure is a $1,200,000 waste heat boiler (top photo) to complete combustion of waste gas and utilize the heat to produce steam for the refining process.

Another major element in the program is the world's largest electric precipitator (lower photo), being built at a cost of $538,000. Catalyst particles entering the unit's chamber gets an electrical charge and is attracted and held by plates with an opposite charge.

The equipment is the latest step in a long battle started against smog by Richfield in 1923.

Shelf Controls Adopted

Two sets of rules established by Interior Department for submerged lands; existing state leases slated for review

WASHINGTON. — Regulations governing mineral leases on submerged lands on the outer Continental Shelf became effective last week after they were approved by Secretary of Interior Douglas McKay.

Two sets of regulations were written after conferences with representatives of the oil industry who recommended changes in the preliminary drafts published in February.

The first set of rules authorizes the Bureau of Land Management to offer leases by competitive bidding. The bureau plans to call for nominations of areas to be offered for lease as soon as plats are prepared. These regulations also provide for the future status of some 400 leases issued by Texas and Louisiana. On the basis of preliminary examination, it appears that nearly all will be converted to federal leases as a matter of routine.

The second set of regulations governs the conduct of prospecting and development operations, including the enforcement of sound conservation means under the U. S. Geological Survey. A supervisory U.S.G.S. office will be opened in the Masonic Temple Building, New Orleans, and a second office is planned in Houston.

Major points in the leasing regulations are:

. . . **All Continental Shelf** lands will be leased competitively on royalty and rental terms to be stated in lease offers.

. . . **Any United States citizen,** association of citizens, or domestic corporation may bid for leases.

. . . **Oil and gas leases** will be for 5 years and so long thereafter as oil or gas is produced, or drilling or well-reworking operations are conducted.

. . . **Sulfur leases** will be for 10 years and so long thereafter as sulfur is produced or plant construction or other operations for its production are conducted.

The operating regulations authorize the oil and gas supervisor of the Geological Survey to approve drilling and development plans, to hold hearings and established production allowables, and to determine and collect rentals and royalties due the United States under terms of the lease.

Initial plans call for the department to confine its leasing activities in the area beyond the 12-mile mark pending clarification of the situation along the Texas border where presently outlined tracts straddle the line and along Louisiana where Louisiana claims jurisdiction for 3 leagues out.

Humble Plans Told

Company maps $14 million offshore program for 1954

HOUSTON.—Humble Oil & Refining Co. plans to spend $14,000,000 this year on offshore drilling and development work. The company plans to:

. . . **Drill three** 14,000-ft. wildcats off the Louisiana coast. One has already been spudded.

. . . **Drill two** wildcats off the South Texas coast. One will go to 12,000 ft. and the other to 10,000 ft.

. . . **Install seven** new platforms, one for each of the wildcat ventures and two for development wells.

. . . **Drill 14** development wells at Grand Isle, Blocks 16 and 19, off Lafourche Parish, Louisiana. Two of these wells will be drilled to 13,000 ft. and 12 to 8,500 ft.

. . . **Drill 20** core tests in Grand Isle salt dome area for subsurface information at depths up to 2,500 ft.

. . . **Lay a new 7-mile** underwater gathering line to take offshore production from Grand Isle platforms, moving it to base headquarters on the island.

Louisiana wildcats . . . Highlighting the current activity are the three wildcats off the Louisiana coast. The new ventures will be located as follows:

. . . **South Timbalier, Block 52.** This well, spudded in the latter part of April, is slated for 14,000 ft.

. . . **South Timbalier, Block 54.** Operations will get under way shortly on this 14,000-ft. well located 14 miles from land in about 50 ft. of water.

. . . **West Delta, Block 30** in the Pelican Island area. This venture, also slated for 14,000 ft. is officially classed by Humble as a "field wildcat." It will be located 20 miles from shore in about 50 ft. of water.

Texas wildcats . . . The two wildcats planned off the South Texas coast have not yet been spotted. However, one test scheduled for 12,000 ft. is to be drilled somewhere off the Aransas County coast and the other, a 10,000 ft. well, will be located off the Nueces County coast.

All seven of the new platforms are of the same general design and will be 75 by 85 ft. Each can handle four or five wells, but can be extended if necessary to care for any additional wells which might be drilled.

Humble has maintained a fleet of 16 converted LST's since 1948. Three are now in service and three more are being readied for use in connection with the new wildcats. Others remain in storage but can be pressed into service on short notice.

Like other companies, Humble has spent millions on the tidelands. It has acquired relatively small production off the Louisiana coast, but efforts so far have failed to bring in any sizable production off Texas.

Humble has discovered six possible salt dome structures off Louisiana since its first Louisiana discovery August 16, 1948, at Grand Isle.

Union Opens New Field

NEW ORLEANS.—Discovery of a new oil field, located 45 miles north of here, in St. James Parish, is reported by Union Oil Co. of California.

The discovery well, 1 Karstien, completed for 175 bbl. of 39°-gravity oil daily with flow restricted to ⅛-in. choke, is on the Richbend prospect, just west of Lagan community, on the east bank of the Mississippi River, where the company has 2,200 acres under lease.

It is 4 miles southwest of the College Point area, and southeast of the old St. James field.

Producing zone is in Miocene sand, opposite which casing is perforated at 10,922-44 ft. Hole was drilled to 11,-300 ft. Oil flow through ⅛-in. choke was under pressure of 2,200 psi.

Sun Plans Offshore Well

CORPUS CHRISTI.—Sun Oil Co.'s first venture into the Texas tidelands will be an 8,000-ft. Kenedy County test to be drilled directionally from a rig site on Padre Island.

The 1,018-1 State-Gulf has been spotted 27 miles east of Sarita and 3 miles east of the north portion of Murdock Pass field, which lines both on Padre Island and in shallow Laguna Madre.

Distillate Strike

Magnolia testing apparent Anadarko basin discovery

ARAPAHO, Okla.—Magnolia Petroleum Co. has a probable deep Springer (Pennsylvanian) discovery in Custer County in the rank wildcat area of the western Anadarko basin.

The 1 Jones, 28 miles south of nearest production at Northeast Seiling pool in Major County, flowed 4 bbl. of distillate in 1 hour on drill-stem test at 11,611-646 ft. Recovery was 100 ft. of distillate. Gas volume was 1,000 M.c.f. per day. Coring is continuing.

The important indicated strike is ½ mile west and ¼ mile south of Parker Drilling Co. 1 Miller, which showed production possibilities but completion attempts were unsuccessful.

Successful completion of the Magnolia wildcat would open first production in Custer County, furthering the prospects of this remote section of the huge Anadarko basin of western Oklahoma.

Pipeline Work Contracted

KANSAS CITY.—Great Lakes Pipe Line Co. has awarded two contracts in the company's expansion program.

R. H. Fulton & Co. of Lubbock, Tex., was successful bidder on 105 miles of 8-in. products line between Alexandria, Minn., and Fargo, N. D. The new extension, which parallels an existing 6-in. line, will provide additional capacity to the company's delivery terminal at Fargo and will make possible increased use of the 6-in. line to Grand Forks, N. D.

Olson Construction Co. of Lincoln, Neb., was awarded the contract on a delivery terminal at Doniphan, Neb. Doniphan will be supplied by a 132-mile, 8-in. line now being laid from Nebraska City as a lateral extension of Great Lakes system.

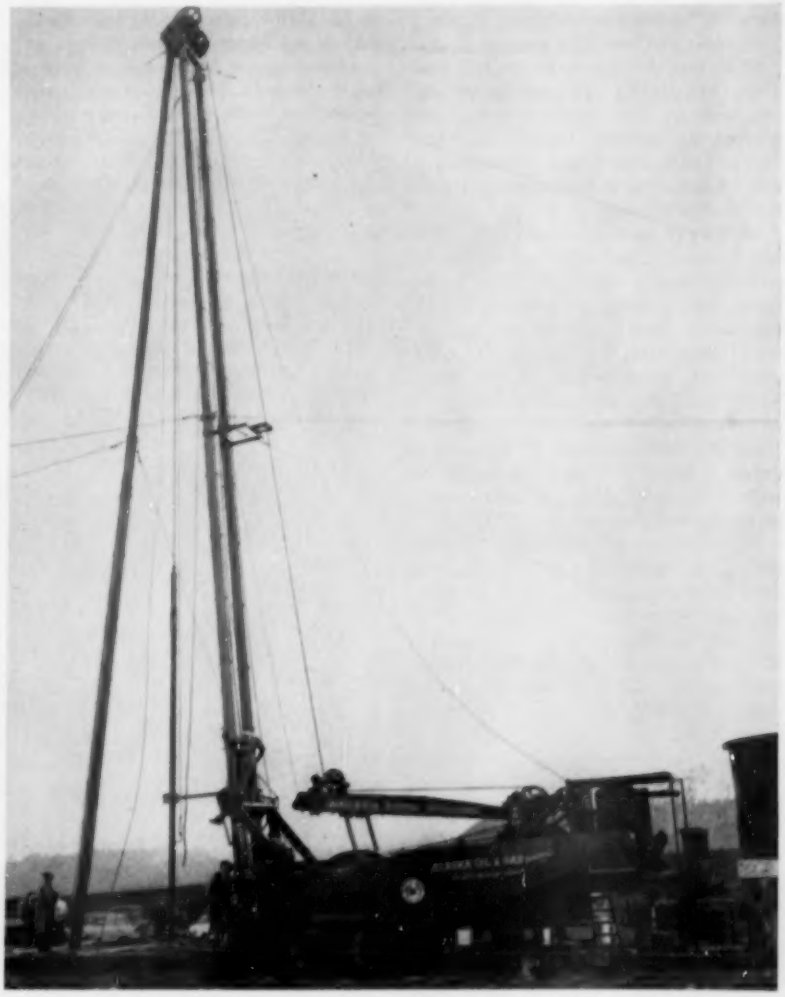
First deliveries of refined products from the new terminal are scheduled to be made by late summer. Construction is slated for completion in November.

$12,000,000 Program Filed

OMAHA. — Northern Natural Gas Co. has filed an application with the Federal Power Commission to construct a 167-mile, 24-in. line from Farmington, Minn., to the Duluth, Minn., area.

Northern proposes to construct a 2,000-hp. compressor unit, branch line facilities, and border stations to serve Duluth and Superior, Wis. In addition, three large-volume industrial consumers located at St. Paul Park and Cloquet, Minn., will buy gas from the new line.

The new system will cost $12,195,300 and is expected to be completed prior to the 1955-1956 heating season. First year peak-day requirements will be 17,982 M.c.f. while fifth year requirements are expected to increase to 52,822 M.c.f.



Rank Wildcat Looking for Oil in Alaska

This is the cable-tool operation being conducted by Alaska Oil & Gas Development Co., Inc., about 125 miles northeast of Anchorage. The well was spudded late last fall, suspended for the winter in late November, and resumed drilling early this month. In 1953 it was the only well drilling in Alaska. Alaska Oil & Gas is an independent company formed by a group of Alaskan business men (The Oil and Gas Journal, April 26, page 123).

Sechura Tests Miss

Richmond's Minchales test latest to be completed dry; geologists caution against writing off entire desert

THE five unsuccessful wildcats drilled thus far in Peru's Sechura Desert have dampened the interest in this previously highly regarded territory.

None of the wells, as far as is known, had so much as a show of oil. The latest was Richmond Oil Co.'s Minchales test about 25 miles north of Belisario which was ended in basement at 5,792 ft. Preliminary reports are that the sixth Sechura test, Union's Piura 1, is beginning to look like another duster.

With two dry holes, Richmond now plans to slacken off and await developments. The company's rig, according to industry reports, is being sent to Costa Rica where presumably it will be used on a forthcoming Union test in that country.

Drilling in the Sechura got under way last summer after the Peruvian Government, acting under its 1952 petroleum law, granted concessions to 13 companies. The first well was International Petroleum Co., Ltd.'s Viru 4-1 about 41 miles southwest of Piura which was abandoned at 7,330 ft. A second International test, Expectativa 1X1, 9 miles northwest of Piura, was dry at 5,684 ft. An earlier Richmond well, Inca 5-1, about 75 miles south of Piura, was abandoned at 5,994 ft.

The most surprising result was obtained by Union Oil Co. of California. That company's Paita 2 well, on acreage taken over from Conorada Petroleum Corp., was abandoned in basement at 1,282 ft., 15 days after drilling started. The well was said to show a complete failure of previous geophysical information.

Future in doubt . . . How many more wells these and the other companies with Sechura acreage are prepared to undertake is not known. Geologists caution against writing off the area's oil prospects on the basis of results to date. Although each unsuccessful test inevitably narrows down the area, large sections remain to be drilled. The Sechura presents a dual problem with some companies looking primarily for Cretaceous production and others, reportedly, including International and Richmond, regarding the Tertiary as the main prospect. In International's La Brea-Parinas producing property north of the Sechura, some 94 per cent of the crude comes from the Tertiary. The next Sechura test is expected to be by Union which has a location about 25 miles east of Paita.

International presumably is in better position than the other operators to continue a long-range Sechura exploratory program. The company has a refinery at Talara, now being expanded to 45,000 bbl. daily capacity, and important marketing interests in Peru and elsewhere along the western part of South America. Its only present major production, aside from a quarter interest in Mene Grande Oil Co.'s production in Venezuela, is La Brea-Parinas, and here the company early in April announced a reduction in drilling due to depletion.

Acreage changes hands . . . Most of the acreage originally granted to 13 separate companies by the Peruvian Government worked down to several major American companies through contracts, purchased interests, transfers, and other arrangements. Union acquired the Conorada acreage and took an interest in the holdings of the Peruvian Sullana company and the Wiese interests. International's second well was drilled on acreage held by the Canadian Seaoil, Ltd., in whose Sechura concessions it acquired a half interest. Richmond has an agreement with Petrolea Peruana, and Texas Petroleum Co. acquired the blocks held by Argentine interests through Peruvian Oil Concessions and Cia. Sud Americana de Petroleo. Texas plans seismograph work on its Sechura concessions as well as in the Montana later this year. In addition to these companies, Gulf Oil Corp. holds concessions in the Sechura.

Exploratory work was touched off in two other sections of Peru following passage of the oil law 2 years ago. In the northern coastal section where the existing producing fields are located, drilling is under way by Douglas Oil Co. which holds offshore acreage contracted from Cia. Petrolera Lobitos and from Petrolera del Pacificio, and by Peruvian Pacific Petroleum Co. (Cities Service and Richfield) on on-shore acreage contracted from Empresa Petrolera Fiscal, the government company. Peruvian Pacific's first well, Tabloza 12-1, east of the Lobitos area, was dry at 5,560 ft. Another well, 10-1, has been commenced.

Exploration in Peru's Montana east of the Andes is in an early stage.

Shipping Point for Eastern Venezuela Crude

Major shipping point for the light crude produced in eastern Venezuela is Puerto La Cruz. Pipelines extending from most of the eastern Venezuela fields terminate at the port. Near by are refineries operated by Gulf and Sinclair. This Socony-Vacuum photo shows tankers lifting crude at Puerto La Cruz. Most of the approximately 65,000 bbl. daily produced by Socony-Vacuum Oil Co. of Venezuela is shipped from Puerto La Cruz to Socony-Vacuum refineries at Paulsboro, N. J., and Brooklyn, N. Y.

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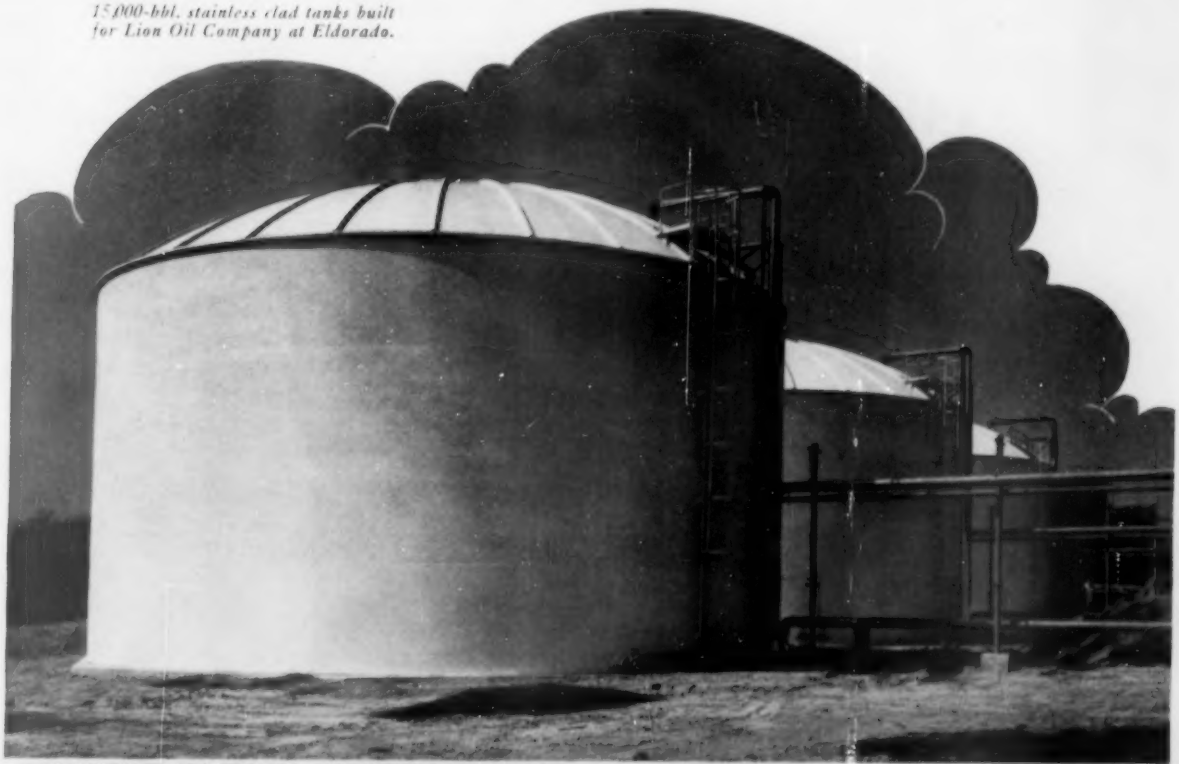
15,000-bbl. stainless clad tanks built for Lion Oil Company at Eldorado.



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Detroit, 26.....1514 Lafayette Bldg.
Houston, 2.....2119 C & I Life Bldg.
Los Angeles, 17.....1523 General Petroleum Bldg.
New York, 6.....3347—165 Broadway Bldg.
Philadelphia, 3.....1615—1700 Walnut Street Bldg.
Pittsburgh, 19.....3228 Alcoa Bldg.
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The missing joints aren't an oversight. They are a saving, made possible by using long, 50-foot lengths of Armco Welded Steel Pipe.

With Armco Pipe, only 106 joints are required per mile. That's 26 fewer than with shorter, 40-foot pipe. You eliminate the time, trouble and cost of making one joint in every five. The long lengths of Armco Pipe mean fewer pieces to haul and handle, too. Installation speeds along. Costs stay low.

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Armco Welded Steel Pipe is recommended for requirements in the Natural Gasoline and Natural Gas Divisions and wherever else you need dependable line pipe. Write us for complete information. Armco Drainage & Metal Products, Inc., Welded Pipe Sales Division, 3344 Curtis Street, Middletown, Ohio. 201 KOME Building, Tulsa, Oklahoma. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.

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Turkish Permits Asked

Three companies seek nonexclusive exploration rights under terms of Turkey's newly enacted petroleum law

THREE companies thus far—Socony-Vacuum Oil Co., Inc., American Overseas Petroleum, Ltd. (Caltex), and Royal Dutch-Shell—have filed applications for nonexclusive exploration permits under the new Turkish petroleum law.

The permits allow the companies to continue preliminary geological work begun prior to the passage of the law under government letters of authorization. The permits allow this type of work over the entire country except in the reserve zones.

The filings for the permits appear to have little significance other than as an indication of continued interest. Work under the old letters of authorization is no longer permitted, but presumably some of the companies have already done sufficient work of this nature. Among the other companies that have been studying Turkey's prospects are Standard Oil Co. (N. J.), Conorada Petroleum Corp., Cities Service Co., and the Pantepec interests.

Real test later . . . The real test of the extent of full-fledged exploratory work to be undertaken in Turkey will come later this year following promulgation of the regulations to the law and the opening of the filing period for exclusive exploration licenses over definite areas.

The regulations are not expected to be out until at least August, and some industry observers expect it may be as late as November. Reports are that E. N. Egeran, French-educated Turkish geologist who has been consultant to the M.T.A. (Turkish Mineral Institute) will come to the United States next month to work with Max Ball and Elmer Batzell, Washington consultants, on these detailed rules to implement the legislation. The feeling is that the law leaves considerable to be spelled out in the regulations.

There is some apprehension in industry circles over the position that will be taken by the newly created Turkish National Petroleum Co. (Turk Petrolleri Amonim Ortak Ligi). This company was established in a companion measure to the new oil law. It will be 51 per cent government owned.

Government company . . . Originally, it was expected that the government organization would be confined to operating the existing two M.T.A. fields in southeastern Turkey and the new refinery being built. However, the final law gives this company authority to seek exploration concessions on equal basis with private interests. Some of the companies now interested in Turkey would probably withdraw if there is any tendency on the part of the government to give the government group a preferred or monopoly position regarding the most promising acreage.

More encouraging insofar as oil exploration is concerned was the victory of the incumbent Democratic party of President Celal Bayar in the national elections in Turkey recently. This party, whose leaders pushed through the oil "denationalization" program, was returned for another 4 years' rule.

New Egyptian Well

Second well on peninsula flows 50 bbl. per hour

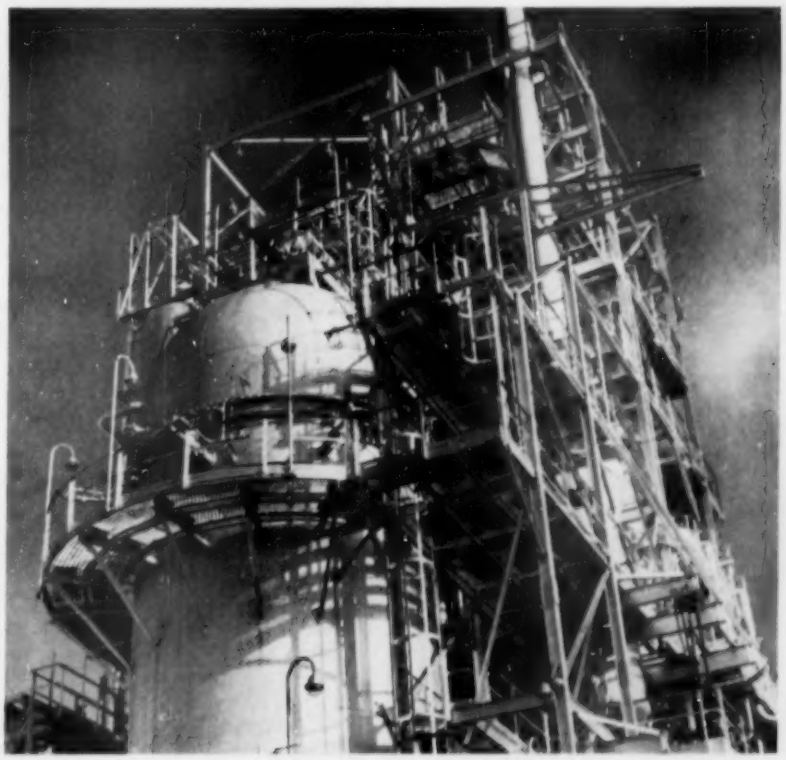
THE International Egyptian Oil Co., Inc., has completed its second well on the Sinai Peninsula of Egypt.

Feiran 2, a ⅓-mile west stepout to the discovery well completed in 1949 by Standard Oil Co. (N. J.), is flowing 50 bbl. per hour of 22.8°-gravity oil through a ¾-in. choke.

Production is from a Miocene sand, gun perforated through 7-in. casing from 6,804 to 6,948 ft. and through open-hole formation from 6,948 to 6,956 ft.

Two 10,000-bbl. tanks are being erected near the well on the beach adjacent to the Gulf of Suez. Marine

(Continued on page 202)



New Fluid Cat on Stream at Big French Refinery

This new fluid catalytic cracking unit of about 8,000 bbl. daily capacity is a part of the facilities operated at Berre l'Etang, near Marseilles, France, by Cie. de Raffinage Shell Berre. With a distillation capacity of about 70,000 bbl. daily, the refinery is now one of the largest in France. Other new facilities include a sulfur-extraction plant. In addition, near by is a new chemical plant operated by Shell Saint-Gobain and having a planned annual production of 7,500 tons of acetone and mixed solvents. The Shell Berre company was formed in 1947 by Shell Francaise and Cie. des Produits Chimiques et Raffineries de Berre; S.A. des Produits Chimiques Shell Saint-Gobain was organized jointly in 1949 by Shell and Cie. de Saint-Gobain, a major French chemical concern.

Flexibility

. . . It's a must in petrochemical plants today

by Gerald L. Farrar
Engineering Editor

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A 3-Part Discussion

- **Reserve**
- **Product**
- **Economic aspects**

THE rapidly changing markets for petrochemicals make it mandatory that the petrochemical plant be extremely flexible in utilization of raw materials, capacity, and product distribution.

This article was written using presented papers and informal discussions from the recent annual national meeting of the American Chemical Society in Kansas City.

Papers used in compilation of this material include (1) Building Economic Flexibility into the Plant, by Herman W. Zabel and Roger Williams, Technical & Economic Services, Inc., New York; (2) Flexibility of Product Distribution in Petrochemicals Production, by C. C. King and M. M. Perkins, M. W. Kellogg, New York; and (3) Reserve Flexibility in the Design of Petrochemical Plants, by R. V. Wallin and Roland Voorhees, Carbide & Carbon Chemicals Co., South Charleston, W. Va.

TYPICAL OF MANY Gulf Coast plants is the flexibility of operation of the Port Neches, Tex., plant of Jefferson Chemical Co., Inc. Here is a night view of the ethylene unit.

1. Reserve Flexibility in Design

RESERVE flexibility in the design of petrochemical plants is provided for by three methods:

- The design basis, which must of necessity be on the conservative side.
- Deliberate inclusion of flexibility factors to insure continuity of operation.
- Deliberate equipment arrangements and design to accomodate expansion of capacity by additions of equipment and by elimination of bottlenecks.

Reserve flexibility is to a significant degree an inherent characteristic of most petrochemical plants.

Consider a distillation column in the plant. The capacity is dependent on the operating conditions. If purity of 99 per cent is sufficient, the capacity is one figure; if requirements change and purity of 99.9 per cent is called for, the capacity is much lower.

The capacity of a heat exchanger depends on several operating conditions, such as the rate of flow of cooling water, the temperature of the water, the cleanliness of the tubes, and the rate of flow of the process stream. A very small change in the temperature approach may result in a very large change in the capacity to transfer heat.

Carbide method . . . The process engineers of Carbide & Carbon Chemicals Corp. establish a design basis by working closely with research and production groups.

Once the design basis has been established, it is strictly adhered to. At this stage, no thought is given to future expansion or the possibility of using the plant for some other product. The design basis itself establishes the over-all safety factor for the design of the plant.

In addition to this reserve flexibility which results from the inherent nature of a chemical plant, there are several

others. Two of the most important of these are (1) reserve flexibility for continuity of operation, and (2) reserve flexibility to accommodate expansion of capacity by additions of equipment and by elimination of bottlenecks.

Operation continuity . . . Petrochemical plants are generally continuous-process plants. They are shut down only when necessary for a major overhaul or when some rare unpredictable major operating trouble arises.

The most common provision of flexibility for continuity of operation is in the form of spare facilities, normally idle but always ready to take over in case of failure of the on-stream equipment. Pumps, compressors, and other mechanical equipment with moving parts are the items for which spares are most frequently provided.

However, spares are not provided for all pumps and compressors in continuous service. If, for example, a compressor represents a large investment, it may be more economical to suffer the production loss in case of compressor failure than to tie up a large investment in idle equipment.

If the compressor is in parallel service with another unit, it may be decided to make each one 50 per cent oversize at much less cost than providing two units of the required size, with a third unit as spare. With two such compressors, the plant can be operated at 75 per cent of capacity when one of the two parallel machines is out of service.

If there are several parallel units, it may be decided to provide no spare capacity at all, and suffer a small loss of capacity when one is out of service.

Normal practice with centrifugal pumps is to provide spares, most frequently as a single spare serving two pumps in two different services, with valves or prefabricated filler pieces for ready switchover. Very rarely are spares provided for centrifugal pumps in intermittent service.

Spare transfer lines are installed where the service is extremely severe with respect to fouling or corrosion. Such a spare line is arranged so that only a very brief pause in the flow is necessary to make the connections and put the spare line into service.

Spares are rarely provided for heat exchangers, but on occasion and if practical, arrangements are made for bypassing. The resulting inefficiency in heat recovery during the short period the exchanger is out of service is accepted. If temporary loss of heat transfer cannot be tolerated, a spare may be provided, or one extra body may be added to a multibody installation.

Future expansion . . . The petrochemical industry is subject to continual change and development. A more effective catalyst may be found; a change in raw material may result in the formation of new byproducts; new products are developed and manufactured. The design engineer must make an effort to provide reserve flexibility to accommodate these future alterations.

Congestion in the arrangement of process equipment should be avoided. Future needs may dictate the need for more reactors, more cycle machines, more distillation columns, and other equipment. Processing steps should be segregated by general character. Reaction equipment should be separated from distillation equipment, and room left for parallel additions to both.

A plan may be outlined for future expansion whereby a distillation column used in the initial installation to refine the product may be visualized as the future forecolumn for stripping off low-boiling byproducts. In this case, space would be left for a new and larger refining still

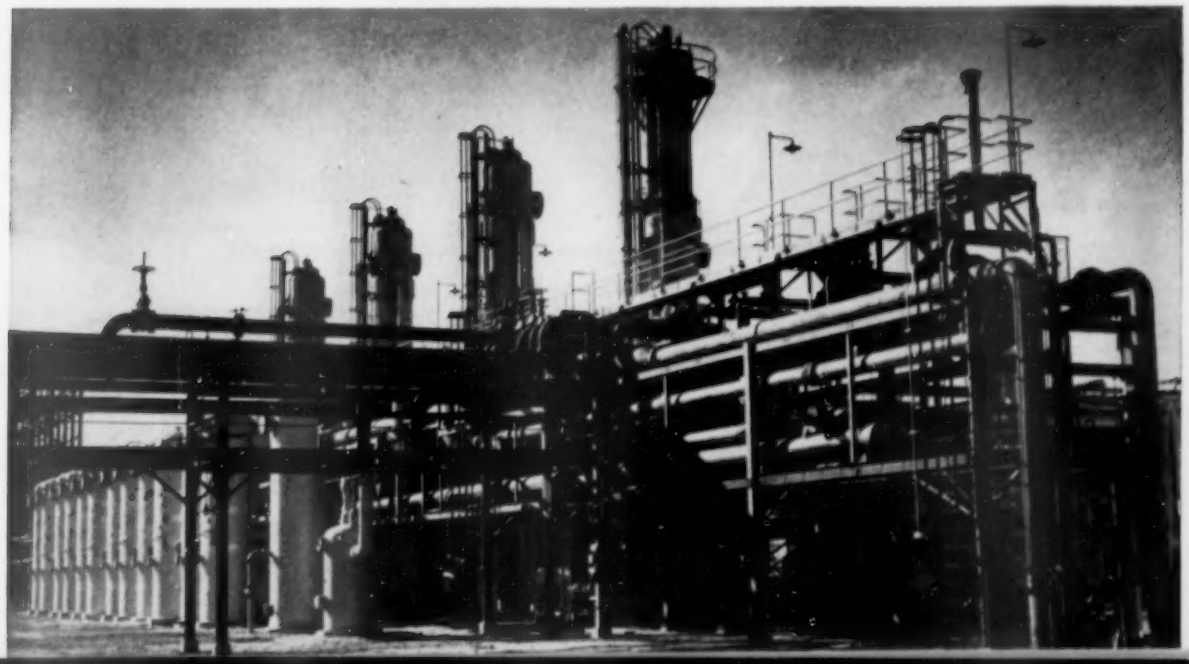
Control buildings are planned so that they can be extended to parallel the extensions of equipment and piping structures. Also, they are arranged for convenient enlargement of the instrument control room without interference from electrical switch rooms, compressor rooms, offices, etc.

Tank areas are segregated from processing-equipment areas and are oriented to accept parallel extension along with the processing areas.

Space is allotted and reserved for piping. Channels are established for piping routes, with some channels to be used only for north-south or east-west travel of horizontal piping, and some channels only for vertical travel. Flat turns are usually avoided, to prevent interference as piping leaves one channel for another. By this method, piping additions can be made with orderly and straightforward routing of the new lines.

All pieces of equipment are provided with spare connections, ready to accept future piping. Connection sizes on such items as still columns, condensers, and tanks are standardized. In this manner equipment can be readily switched from one service to another.

THESE GAS-PROCESSING units at the Carbide & Carbon Chemicals Co. Texas City, Tex., plant lend flexibility to the many operations carried out in the plant.



. . . Of Product Distribution

FLEXIBILITY of product distribution in petrochemicals manufacture can usually be provided at a cost of approximately 10 per cent more than that of a plant designed for one specific inflexible operation.

Thus increase in cost due to provision for flexibility is nominal, since only incremental increases in relatively few pieces of equipment are required. Reactors, fractionating equipment, and the like must be sized to take care of maximum loads that usually can be anticipated in advance.

Product flexibility in a petrochemical plant is advantageous for several reasons. Among these are:

- The market for a given product may be seasonal, and storage to take care of a fluctuating demand may be too expensive.
- A plant making several chemical products may be faced with expanding markets with different rates of increase for the various products.
- Demand for older products or products made by older processes may decrease.

Certain chemical processes possess natural flexibility in their operating characteristics which permit the processes to vary the products made whereas other processes are inherently inflexible. An example of an inflexible process is the cumene oxidation process for phenol and acetone. Phenol and acetone are produced in a fixed stoichiometric ratio in this process which forces one into developing an acetone market fixed in relation to the phenol produced.

The cumene oxidation process does possess one other interesting kind of flexibility, however. It will operate on a whole series of feed stocks to produce similar oxidation products. With cumene as feed, phenol and acetone are produced. By changing the feed to p-cymene, p-cresol and acetone may be produced.

Petrochemical process . . . To illustrate this concept of product flexibility, consider a process for making chemicals by cracking petroleum. In the initial cracking step the crude oil is converted to many of the intermediates required to manufacture the end chemical products. Since there is a wide variety of products produced in the cracking process each of which is in turn used as a raw material for the production of a number of more complex chemical end products, the key to flexibility in the production of these chemicals lies in the cracking process itself.

By employing a cracking operation which possesses flexibility in product distribution, a reasonable variation can be achieved in the final products from a given chemical processing sequence.

The product distribution which may be obtained by severe cracking of 10,000 bbl. per stream day of a paraffinic-base crude oil is shown in Table 1. The butene-butadiene product obtained in this operation would contain about 50 per cent by weight of butadiene, the remainder being butylenes. The gasoline product from such an operation would be extremely aromatic and could be fractionated to produce large quantities of benzene, toluene, and xylenes.

Mild cracking . . . Cracking the same quantity of crude oil under milder conditions gives a product distribution shown in Table 2. The yield of ethylene is considerably lower than in the severe cracking operation. The yields of propylene and butene-butadiene are only slightly lower. However, the butene-butadiene product now contains only 20-25 per cent by weight of butadiene, the remainder being butylenes.

The yield of gasoline is considerably higher and this product is not quite so rich in aromatics as indicated by the lower octane number. Fuel gas yield is down and fuel oil is up.

A further variation in product yields may be obtained in this processing sequence by varying the type of crude oil charged. These flexibility factors are particularly valuable since they permit variation between the production of olefins and the production of aromatics. The yields given in Tables 1 and 2 are both based on paraffinic crude oil such as Iraq or East Texas crudes. The yield of benzene in the severe cracking case from such a crude would be about 4-6 weight per cent. The correspond-

TABLE 1—PRODUCT DISTRIBUTION FROM SEVERE CRACKING OF CRUDE OIL

	Crude oil	Ethylene product	Propylene product	Butene-butadiene product	Gasoline	Fuel gas	Heavy fuel oil
Volume per cent on crude	100.0	.....	17.3	8.9	20.2	.....	25.4
Barrels per stream day	10,000	.....	1,731	889	2,021	.....	2,543
°A.P.I.	36.2	.....	.....	.....	35.3	.....	2.3
Pounds per gallon	7.03	.....	4.33	5.19	7.06	.....	8.81
Gallons per hour	17,500	.....	3,030	1,556	3,536	.....	4,451
Pounds per hour	122,960	20,870	13,130	8,070	24,970	16,720	39,210
Weight per cent	100.0	17.0	10.7	6.6	.....	13.6	.....
Sulfur, weight per cent	2.0	.....	.....	.....	0.34	.....	3.5
C.F.R.-R. (clear)	.....	.....	.....	.....	98.2	.....	.....
R.v.p.	.....	.....	.....	.....	3.6	.....	.....
Viscosity S.F.s. at 122° F.	.....	.....	.....	.....	.....	.....	3,500

TABLE 2—PRODUCT DISTRIBUTION FROM MILD CRACKING OF CRUDE OIL

	Crude oil	Ethylene product	Propylene product	Butene-butadiene product	Gasoline	Fuel gas	Heavy fuel oil
Volume per cent on crude	100.0	.....	16.6	7.7	29.7	.....	30.9
Barrels per stream day	10,000	.....	1,656	771	2,965	.....	3,090
°A.P.I.	36.2	.....	.....	.....	45.6	.....	9.5
Pounds per gallon	7.03	.....	4.33	5.19	6.65	.....	8.35
Gallons per hour	17,500	.....	2,900	1,350	5,190	.....	540
Pounds per hour	122,950	13,500	12,530	7,000	34,500	10,930	45,100
Weight per cent	100.0	11.0	10.2	5.7	.....	8.9	.....
Sulfur, weight per cent	2.0	.....	.....	.....	0.38	.....	3.4
C.F.R.-R. (clear)	.....	.....	.....	.....	88.4	.....	.....
R.v.p.	.....	.....	.....	.....	3.7	.....	.....
Viscosity S.F.s. at 122° F.	.....	.....	.....	.....	.....	.....	3,100

ing yields of toluene and xylenes would each be 3-5 weight per cent.

Mild cracking using paraffinic crude oil gives yields of benzene of 1-2 weight per cent, toluene of 3-4 weight per cent, and xylenes of 4-5 weight per cent.

Aromatics increase . . . The yields of aromatics may be increased twofold or more, depending on the exact nature of the crude oil used. At the same time, the yields of gaseous components will be decreased by an amount corresponding to the increase in liquid product yields.

Thus, in one unit these possibilities exist: (1) varying yields of olefins with respect to one another by changing cracking conditions, (2) varying yields by changing cracking conditions, and (3) varying yields of olefins with respect to aromatics by changing feed stock.

The economics of operating a 10,000-bbl. per stream day crude-oil cracking unit for the production of petrochemicals have been studied. A summary of direct operating costs of such a plant in an East Coast location shows total operating costs to be $7,200 per calendar day at 90 per cent stream factor. These operating costs may be assumed to apply for any operation of the plant even though in actual practice there would be some slight variation in direct operating costs with the severity of cracking.

An over-all economics summary for the severe cracking of 10,000 bbl. per stream day of paraffinic crude oil is shown in Table 3. This operation shows an attractive payout of 1.82 years before taxes and depreciation. In this economic summary the aromatics have not been separated from the gasoline and the gasoline has been credited merely as a motor fuel. Normally the chemical manufacturer would find it more attractive to recover the aromatics from this gasoline which he would then work up to valuable chemical products.

. . . And Raw-Material Supply

PERHAPS the most important degree of freedom that can be made available by proper plant design is flexibility in the raw-material supply to the plant. Such flexibility is particularly important for those materials manufactured in tonnage quantities.

Raw material flexibility can be furnished by the ability to use a raw material with widely varying degrees of purity; a different ultimate raw-material source; or perhaps a waste product from a nearby source could make up the feed stock. Each of these alternatives can and is being used.

Maximum flexibility is provided by utilization of as many of these routes as possible; not all in one operating unit, but by having multiple sources of raw materials available to protect the plant operator as much as possible from the continual shifts in raw material prices.

Ammonia plant . . . A certain degree of economic freedom in raw-material supply can be built into almost any plant. As an example consider a nitrogen-fixation plant.

Hydrogen for ammonia manufacture can be and has been prepared from almost all carbonaceous raw materials. In India wood is being used for one plant. But in the United States coal and petroleum hydrocarbons supply the bulk of the raw material for ammonia manufacture. Thus a high degree of economic flexibility could be provided by so locating and so designing the synthetic ammonia plant that either of these two raw materials could be utilized.

It is impractical from a cost standpoint to set up a plant with equipment to use both coal and natural gas. But, for all practical purposes, the same results can be achieved by proper design and choice of the starting raw material.

At the moment it is less costly to manufacture ammonia from natural gas for practically all parts of the United States. However, it is extremely questionable whether this situation will persist over the life of an ammonia synthesis unit. Our studies indicate that within a period of 10 to 15 years ammonia producers in many parts of the United States will find it prudent to shift back to coal.

If true, a question immediately confronts the plant designer. It is: What method should be chosen for feed gas production from natural gas to facili-

TABLE 3—OVER-ALL ECONOMIC SUMMARY SEVERE CRACKING 10,000 BBL. PER STREAM DAY PARAFFINIC CRUDE OIL

	Unit value	B.P.S.D.	B.P.C.D.	Lb./S.D.	Lb./C.D.	$/C.D.
PRODUCT CREDITS:						
Gasoline	*13.5	2,021	1,819	.....	.....	10,314
Ethylene	†5	....	....	500,880	450,790	22,540
Propylene	*8.5	1,731	1,558	.....	.....	5,562
Butene-butadiene	*24.0	889	800	.....	.....	8,064
Fuel gas (F.O.E.)	‡$2.20	1,437	1,293	.....	.....	2,845
Heavy fuel oil	‡$2.20	2,543	2,289	.....	.....	5,036
Total credits						54,361
DEBITS:						
Crude (delivered)	‡$3.23	10,000	9,000	.....	.....	29,070
Direct operating costs	....	....	....	.....	.....	7,232
Maintenance at 4 per cent of investment	....	....	....	.....	.....	1,096
Prop. taxes and insurance at 3 per cent of investment	....	....	....	.....	.....	822
Interest at 4 per cent of investment	....	....	....	.....	.....	1,096
Total debits						39,316
Net credits	....	....	....	.....	.....	15,045
Net credits—$/year	....	....	....	.....	.....	5,491,425
Estimated investment (process equipment only)	....	....	....	.....	.....	10,000,000
Payout on investment, years§	....	....	....	.....	.....	1.82
Net return over investment after 7½ years' operation	....	....	....	.....	.....	31,185,688

*Cents per gallon. †Cents per pound. ‡Per barrel. §Before taxes and depreciation.

PRODUCT FLEXIBILITY is inherent in the design and operation of the Celanese Corp. of America plant at Pampa, Tex. Designed for production of acetic acid, the plant can produce many coproducts if desired.

Flexibility in Petrochemical Plants

tate later conversion of the plant to the use of coal as a raw material? Purely from the standpoint of obtaining a greater degree of economic freedom, partial combustion with tonnage oxygen should be chosen.

Feed switch . . . In any switch from natural gas to coal a very major portion of the feed-gas production unit can be used in the gasification of the coal, reducing the quantity of equipment that must be scrapped to a minimum. The stoichiometry of the reactions involved, however, is such that the size of the oxygen plant will necessarily have to be doubled to provide the same amount of feed gas to the ammonia converters.

Still Another Dividend

There is still another dividend to be gained from the use of oxygen. The tonnage oxygen plant provides a stream of liquid nitrogen simultaneously with the production of oxygen. This stream is an ideal means for removing the final traces of carbon monoxide, carbon dioxide, and sulfur compounds that remain after the gas is scrubbed with alkali. In addition to cleanup of traces of these materials the argon content of the gas stream is also removed.

If this nitrogen stream were not available additional capital investment would have to be utilized in order to facilitate the complete removal of the sulfur compounds and carbon monoxide which poison the ammonia producing catalyst. Thus a degree of economic freedom is incorporated into the plant which will be particularly important when using sulfur-containing coal as a raw material.

The ideal time table for a new ammonia installation then would be: (1) start up the plant on natural gas using oxygen conversion, (2) to use natural gas as a raw material until the price rises to the point where the use of coal becomes economic, (3) double the size of the oxygen plant and install the other necessary equipment for manufacture of the required feed gas from coal.

A major function of the plant designer in this time table is to provide space at the proper location and set up the plant layouts so that the requisite new equipment can be installed when required at minimum cost. Naturally he also will receive the problems and headaches that are required in the actual design of the plant.

Products . . . Use of an oxygen plant has been employed by one ammonia producer to provide a degree of freedom with respect to product. Using byproduct hydrogen from hydrocarbon dehydrogenation as the basic raw material for ammonia manufacture, he has constructed an oxygen plant to provide a liquid nitrogen stream with which to scrub the feed gas to the converters.

At the moment the coproduced oxygen is not being used. However, oxygen can be and is being utilized by industry for the manufacture of a host of other materials. Consequently it will not long remain unused.

Markets . . . With practically no exceptions the economic degrees of freedom in the marketing of any tonnage product are controlled by transportation. That is, the distance that a product can be carried before material produced at another location will force the plant operator to absorb freight if his product is to remain competitive and thus have the opportunity to capture its share of the market.

From the standpoint of stability it would be desirable for the plant to have markets, in the case of ammonia, and its derivatives, not only in the major field—that of fertilizers, but also in the industrial market. To supply the many industrial uses such as synthetic fibers, plastics, and explosives involves a very careful perusal of plant location, freight rate charts and other studies to determine if it is feasible to provide this additional degree of economic freedom.

The importance of transportation can perhaps best be illustrated by drawing at random from certain freight-rate studies which we recently made on ammonia. Freight rates being what they are, it is extremely difficult to generalize. However, the cost of shipping liquid anhydrous ammonia about 300 miles (as the crow flies) by tank car was roughly 35-40 cents per hundred pounds or $7-$8 per ton. It is obvious that freight is an item which represents approximately 8 per cent of the total price of the material. Obviously any item representing 8 per cent of gross sales must be carefully watched.

NATURAL-GAS PRODUCTION . . . A panel discussion at the New Orleans meeting of the American Gas Association was headed by this group of experts. W. T. Hollis, El Paso Natural Gas Co., Farmington, N. M., author of the accompanying paper, is seated second from left. The panel includes (left to right): C. J. Wilhelm, U. S. Bureau of Mines, Bartlesville, Okla.; Hollis; T. W. Johnson, Union Producing Co., Shreveport (presiding); G. C. Howard, Stanolind Oil & Gas Co., Tulsa; and Russel W. Hofsess, Cities Service Gas Co., Oklahoma City.

MUDLESS DRILLING

DRILLING WITH GAS . . .

It got the job done in San Juan basin, where lost-circulation problems made mud impracticable

by W. T. Hollis

IN 1950, El Paso Natural Gas Co. was faced with the problem of having to drill some 500 to 600 gas wells in the San Juan basin of northwest New Mexico. The need for such a program was to supply gas for the California market.

These wells were to be completed in the Mesaverde formation of Cretaceous age, which consists of 800 ft. of interbedded sands, shales, and coal, at an average depth of 5,000 ft.! This gas-saturated formation has very low porosity, permeability, and a reservoir pressure of 1,280 psig. Wells range in natural potential from less than 100 to 5,000 M.c.f.d., while after shooting their potentials increase from 2,000 to 20,000 M.c.f.d.

Due to lost-circulation problems it was practically impossible to drill the Mesaverde with mud without experiencing excessive mud costs as well as the plugging action of lost circulation material on the gas zone. Further damage to the formation was caused by the swelling action of bentonite, within the gas zone, when drilling mud and water came in contact with it.

Cable-tool drilling was tried with the results being slow completions and continuous fishing jobs. It would often take 5 to 8 weeks to drill the 800 ft. of hole, and after shooting this interval "open" with as much as 2,300 qt. of solidified nitroglycerin, the cleaning-out process further increased the hazards of cable-tool operations. Therefore, in order to meet market demands and drilling commitments, it became apparent that a faster and more economical completion method had to be developed, as well as some method which would insure a clean producing formation so as to increase potentials and deliverability.

Gas drilling . . . First experiment with this technique was begun on May 2, 1951, and the 827 ft. of hole was drilled in 27 hours of total elapsed time. This included two trips to change and inspect the bits, which was unnecessary as both bits were pulled "green." The hole was then shot and cleaned out with gas without difficulty.

The well-head hookup underneath the rig floor consists of: a 7-in. master valve on top of the tubing head, then the blowout preventer, next a tee which is used for the vent-line connection, and finally the rotating drilling head which forms the seal around the drill pipe and kelly. Drilling gas, which is obtained from a nearby well or pipe line, is brought into the standpipe at an average pressure of 400 psig. and 2,200 M.c.f. It flows through the rubber drilling hose, down the drill pipe, around the bit, up the annulus, out the flow line, and is burned 300 ft. from the rig.

The only extra equipment required for gas drilling is the master valve, tee, rotating head, and a simple piping setup for the drilling gas system. It has been found that the conventional hard-formation-type bit is just as effective as the specially designed air jet bit.

When drilling at a depth of 5,000 ft., the samples will reach the surface in 1 to 2 minutes and are in a fine powder form, similar to face powder or dust. As the bit drills through different formations the color of this dust will change. For instance, a coal formation will have a black dust, a shale formation dark brown, and a sand will be white. Visual inspection of the flow line will indicate the type formation being drilled and a lithologic log of the well can be obtained

by merely catching the samples at the end of the flow line.

Results for Gas Drilling

Costs of wells in the San Juan basin have been decreased approximately $20,000 per well, and completion time as much as a month to 6 weeks, but the most important result has been the increased potentials and higher deliverabilities. For example, there were three particular wells that were completed for a potential of approximately 500 M.c.f.d. by the use of conventional methods. But after plugging back, milling a window, and drilling a directional hole with gas, these same wells were completed for a potential of 5,000 M.c.f.d.

Since the date of our first experiment, we have drilled 295 wells with gas and other operators have drilled approximately 300 more for a total of approximately 600 wells. The following average data has been compiled from our operations:

Average Per Well, Gas Drilling

1. Gas volume used, M.c.f.d.	2,200
2. Gas pressure used, psig.	400
3. Length of time to drill the average footage of 782 ft./well, days	4.6
4. Drilling time:	
Upper Mesaverde, minutes per foot	4
Middle and lower Mesaverde, minute per foot	1
5. Footage drilled per bit	264
6. Weight on bit, lb.	12,000
7. Size of bits, in.	6¼
8. Maximum footage drilled with one bit	891
9. Rotary speed, r.p.m.	70
10. Maximum size hole drilled, in.	11

Diamond Coring Data

Using the conventional diamond core barrel and core head we have cored the sand members of the Mesaverde in seven wells with the following average data:

1. Gas volume used, M.c.f.d.	2,200
2. Gas pressure used, psig.	400
3. Footage cored	271
4. Coring time, minutes per foot	6
5. Core heads used/well	1-3
6. Weight on core head, lb.	17,000
7. Rotary speed, r.p.m.	40
8. Size of core head, in.	6¼
9. Recovery, per cent	85

Other applications of gas drilling have also been successful such as: (1) milling a window in casing and whipstocking, (2) fishing in open hole, and (3) drain-hole drilling.

Fire is the most commonly considered hazard connected with gas drilling, and certainly it should be given serious consideration. However, if rig personnel are instructed carefully, drilling-head rubbers changed often, engine exhausts injected with water, and the flow lines laid at least 300 ft. from the rig and the gas burned, then there will be little need for concern. There have been four or five fires in the San Juan basin and all of them can be traced to carelessness on the part of the personnel rather than resulting from the actual drilling-with-gas operations. None of these fires occurred during actual drilling operations but were started while landing tubing or while out of the hole changing the bit, due to carelessness or forgetfulness in the use of matches.

Liquid, whether it be water, distillate, or oil, is also a hazard in that it will cause the formations to slough and increase the danger of sticking the drill pipe. Wet cuttings will also form wall cake on the casing, making it difficult and sometimes impossible to make a trip. In our operations we can usually drill the wet spots by increasing the pressure and volume and by only drilling a few feet of hole before making a trip to clean the casing. It sometimes is necessary to set liners through the moisture, squeeze with cement, or return to conventional methods of drilling.

In a few cases large volumes of gas have been encountered and if not handled carefully can be extremely dangerous, especially while making a trip. El Paso has drilled in wells flowing 36 million cubic feet natural and other companies in Utah have drilled in wells flowing as high as 55 M.M.c.f. per day.

The danger of crooked holes is sometimes thought to be greater when using gas than when using mud. However, it is our opinion that the area affects crooked holes more than the circulating medium. While trying to drill one hole from underneath surface pipe with gas, El Paso experienced crooked-hole trouble. However, after returning to mud circulation our troubles were not eliminated. This well was located in an area where steep dips are encountered and crooked holes are frequently drilled.

Sandblasting effects might also be considered as hazardous; however, after 2½ years of operations, there have not been any tool-joint failures due to this action. Erosion does occur on shoulders of standard tool joints but if flush-joint or double-streamline drill pipe is used, the sandblasting effect is not noticeable. Neither has there been any damage to well-head equipment.

The conservation of natural gas is of prime importance in any area. However, we believe that less gas is wasted by gas-drilling operations than by cable-tool drilling, where the formation was allowed to produce to the atmosphere for weeks.

We believe that it is a fair statement to say that drilling with gas has "made" the San Juan basin by putting well completions on an efficient and economical basis. And this technique is rapidly finding its place in the drilling industry in other areas.

Larger Fracturing Jobs Bring Larger Pumping Equipment

by Ed McGhee
District Editor

IN an increasing number of areas, high-injection rate, large-volume formation fracturing is making the difference between noncommercial production and profitable operation.

The steadily growing number of big treatments has necessitated new pumping equipment to accommodate the unprecedented volumes and pumping rates. Latest giant designed for this service is Halliburton Oilwell Cementing Co.'s new lowboy trailer which mounts two engines and two pumps.

The two diesel engines of 300 hp. each make the lowboy the biggest unit from standpoint of horsepower engaged in fracturing work to date.

Some recent fracturing jobs, notably in the Spraberry Trend of West Texas *(see The Oil and Gas Journal, December 28, 1953)*, have used injection rates as high as 65 bbl. per minute for short periods; but rates of 30 to 45 bbl., while more common, are still considered high.

For early jobs with high injection rates, it was often necessary to use as many as seven to nine of the conventional pump trucks then available.

Halliburton's new lowboy unit aims to decrease the number of units needed for a given job. Together the two triplex plunger pumps will handle these volumes:

Pressure (psi.)	Capacity (bbl./min.)
0	18.6
1,000	17.5
2,000	8.0
3,000	5.9
4,000	4.2

Although the two engines are con-

Equipment layout for fracture treatment. Sand is being fed from the bulk truck and oil from the tank into a proportioner-blender. The pump units take suction on the blender.

trolled from a common remote console, they are otherwise separate and drive their respective pumps through single-stage torque converters. The pumps, too, are separate but it is possible to manifold the suction or discharge lines if desirable.

Generally a newly developed sand proportioner-blender is used in conjunction with these lowboy units to make it possible to change the sand-to-oil ratio anytime during the treatment. The selected ratio may be maintained even though the injection rate may vary.

These areas respond . . . Some formations which respond to fracturing do not seem to derive added stimulus from the larger-volume treatments or high injection rates. Some feel that an optimum rate of injection can be determined for each formation above which the slight increase in results are not economical to obtain. There has been a trend toward high injection rates in these areas:

Pine Island field, Louisiana—Annona chalk.

Spraberry field, Texas — Spraberry sand.

Coke County, Texas—Strawn sand.

Pecos, Ward counties, Texas—Yates sand.

Lea County, New Mexico—Yates, Queen sands.

San Juan County, New Mexico—Cliff House sand.

Texas Panhandle—Dolomite.

Russell County, Kansas—Tarkio lime.

Cowley County, Kansas—Bartlesville sand.

Kay County, Oklahoma—Bartlesville, Cleveland sands.

Grass Creek field, Wyoming—Curtis sand.

Midwest field, Wyoming—Second Wall Creek sand.

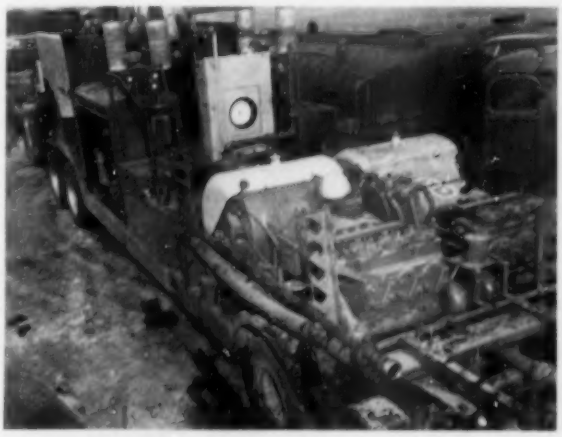
Wayne County, Illinois—Aux Vases sand.

Coshocton, Knox counties, Ohio—Clinton sand.

Pine Island boom . . . Other than the Spraberry Trend, one of the most spectacular areas of activity growing out of the improved completions through hydraulic fracturing is Pine Island field of Caddo Parish, Louisiana. Until recently, the Annona chalk in this old field was not considered productive enough to warrant extensive drilling even though it lies at depths of 1,500 ft. and less.

However, fracturing has improved completions until there are now usually more than 20 new wells completed in the Annona per week. Many old wells in Pine Island field that had previously been stimulated with acid, have responded favorably to fracturing.

Although many treatments in Pine Island involve four zones, almost all include at least three zones, and are generally performed with straddle packers. About 75 per cent of the jobs use in excess of 20,000 lb. of sand per zone with a ratio of 2.5 lb. of sand per gallon of oil.

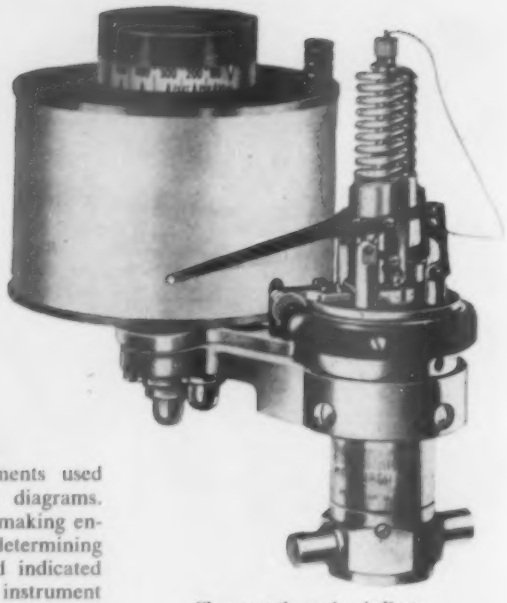


With two 300-hp. diesel engines and two triplex pumps, this lowboy unit will deliver 17.5 bbl. per minute at 1,000 psi. for high-volume, high-injection-rate fracturing.

Engine indicator a valuable tool

Maintaining Compressors At Peak Efficiency

by Earl Y. Palmer



Chronomatic engine indicator.

ONE of the most costly phases of compressor operation is maintaining peak efficiency in the compressor cylinder. A good many compressor operators fail to make use of some of the simple devices and methods of easily maintaining a compressor cylinder in first-class operating condition at a very nominal cost and little loss of horsepower due to down time and faulty compressor cylinder parts.

Most operators maintain scheduled visual compressor cylinder inspections. A large percentage of these visual inspections turn out to have been entirely unnecessary at the time the inspection was made.

This discussion will center around an instrument and a method of using the instrument to indicate when a visual inspection is necessary, and just what to look for during the inspection. An indication of pending compressor failure may often be obtained a considerable time ahead of actual failure. When such an indication is obtained, the operator may make plans for repairs to fit in with his working and operating schedules, thus saving prolonged down time and paying premium wages for unexpected repairs.

Indicator instruments . . . Most operators are familiar with the pressure engine indicator card instruments used for taking pressure-volume diagrams. These diagrams are used in making engineering calculations for determining mean effective pressure and indicated horsepower. This type of instrument requires an indicator reducing motion which is not easily arranged for on modern compressor units: Thus an operator would be required to rely on a pull-card mechanism which is quite unhandy and inaccurate when operated by hand.

Author is with Atlantic Refining Co. Paper presented at N.G.A.A. meeting, Dallas, April 21-23, 1954.

Bacharach Engine Indicator

The type 2-CPT Bacharach chronomatic engine indicator which eliminates the need of an indicating reducing motion is shown in the photo. This chronomatic engine indicator, in addition to being used for engineering purposes, is ideal for taking a pressure-time indicator card which can readily be used to show the interior condition of a compressor cylinder for maintenance purposes.

Pressure record . . . The indicator pressure record is made on a removable chart which is wrapped around the chronomatic drum. The chronomatic drum operation is quite simple and requires no skill or special training. The drum is free rotating and receives propulsion from a helical spring encircling the drum shaft. The drum is designed so that as it continues to spin a uniform speed is obtained for sufficient time to produce a diagram with a constant time scale. The drum surface speed, in feet per minute, at any instant is indicated by the speed indicator on top of the drum.

Pressure-Time Diagram

The pressure-time diagram shows the change of cylinder pressure on a time basis. Since the chronomatic drum surface speed, read in feet per minute, can be adjusted over a broad range, the pressure record may be spread out on the chart over as much space as needed to obtain a clear picture of any portion of the compressor cycle to be studied.

To use the chronomatic engine indicator diagram for compressor cylinder maintenance purposes, a set of pressure-time indicator cards has been developed to help the operator interpret the indicator card which may be taken in the actual operation of a compressor cylinder without any linkage with the engine. The guide indicator cards are shown in Figs. 1 through 10.

Interpretation . . . Fig. 1 shows a per-

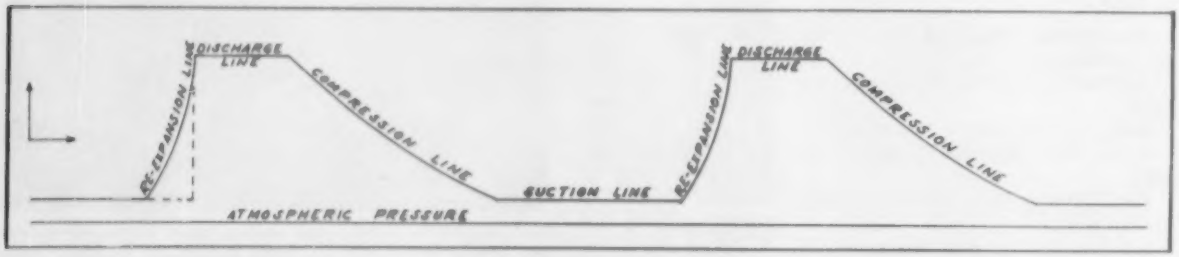


Fig. 1—Perfect card, pressure vs. time.

fect card indicating that the compressor cylinder is in good operating condition. Note that by drawing a perpendicular line from the left side of the discharge line to the horizontal extension of the suction line, and folding to the right on the perpendicular line, a pressure-volume diagram may be created.

Fig. 2 indicates that a suction valve chatters. This is probably due to weak valve springs and may result in a broken valve plate or a leaky valve.

Fig. 3 shows weak springs in the discharge valves, and will result in a broken valve plate or a leaky valve which in turn will result in cylinder heating and loss of horsepower.

Figs. 4 and 5 indicate that the suction and discharge passages are too small. To small a valve lift could also be indicated.

Figs. 6 and 7 show that the valve springs may be too stiff. This means loss of horsepower. Valve springs of the proper tension should be installed.

Fig. 8 shows a typical suction valve leak. The leak may be either in the valve or valve gasket.

Fig. 9 indicates a badly leaking discharge valve (Curve 1) and a slightly leaking discharge valve (Curve 2). The leak may be in the valve or in the valve gasket.

Fig. 10 shows what may be indicated by the compressor piston rings leaking. Leaky piston rings may be due to worn rings, out-of-round compressor cylinders, or weak expander rings used with plastic-type piston rings.

Guide Library

An operator who intends to use an indicator card mechanism for determining when and what to do in the way of compressor cylinder maintenance should establish a guide library for all of his own particular compressor cylinders by obtaining perfect cards when his cylinders are in good condition, and by taking indicator cards on some of his known bad cylinder conditions. In this way an operator will readily become familiar with his own equipment.

In order to attach the engine indicator to a compressor cylinder, it will be necessary to equip both the head and crank ends of the compressor cylinder with a good valve. Normally, less than 5 minutes is required to take each card. Diagrams of both the head and crank ends are normally taken on the same card.

The foregoing discussion has presented a means of using an engine indicator mechanism for maintaining peak compression cylinder efficiency which can save an operator considerable time, money, and horsepower in the operation of a compression plant.

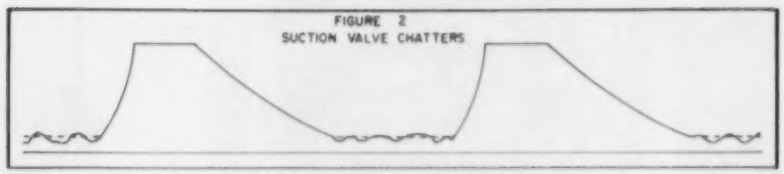


FIGURE 2
SUCTION VALVE CHATTERS

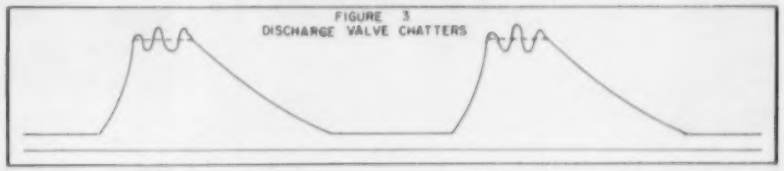


FIGURE 3
DISCHARGE VALVE CHATTERS

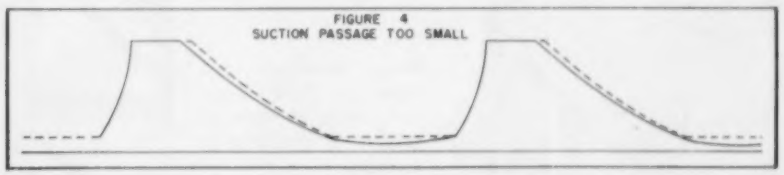


FIGURE 4
SUCTION PASSAGE TOO SMALL

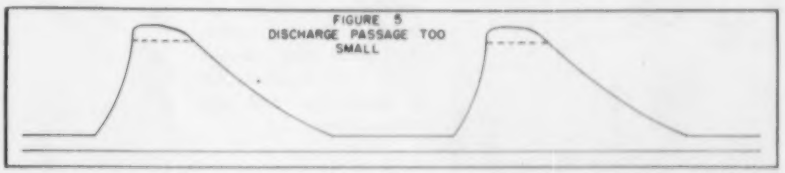


FIGURE 5
DISCHARGE PASSAGE TOO SMALL

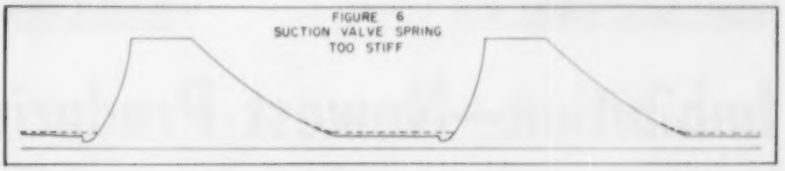


FIGURE 6
SUCTION VALVE SPRING TOO STIFF

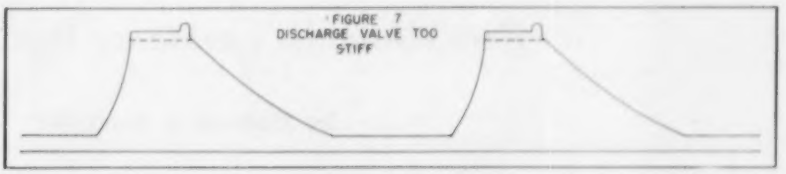


FIGURE 7
DISCHARGE VALVE TOO STIFF

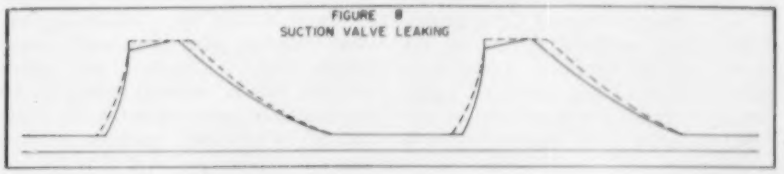


FIGURE 8
SUCTION VALVE LEAKING

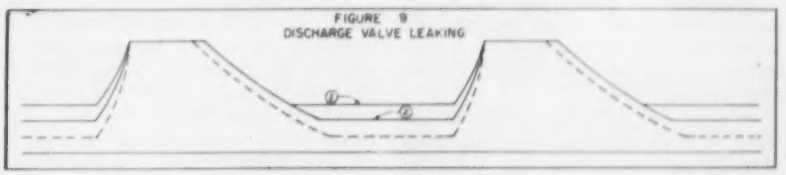


FIGURE 9
DISCHARGE VALVE LEAKING

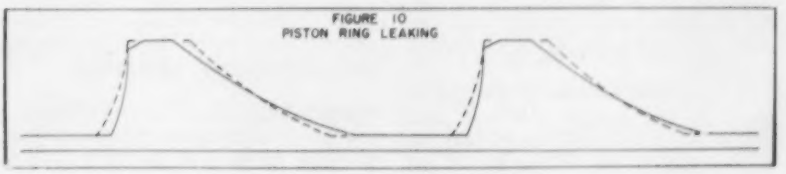


FIGURE 10
PISTON RING LEAKING

These Spraberry sand wells in West Texas are among the first to recover oil produced as a result of a planned imbibition program. All these wells lie within the area that would have been flooded out if imbibition had not taken place.

Imbibition—Newest Producing Technique

Here's Atlantic's evidence that theory is a proved fact

by Robert J. Enright

ENGINEERS who have been following Atlantic Refining Co.'s experimental water-injection project in the Driver area of Spraberry Trend Area field in Midland and Glasscock counties, West Texas, are convinced by evidence collected so far that imbibition is taking place.

Increased oil production has shown up in wells ¾ mile from the injection wells, and injected water is being produced in well ½ mile removed from the injection wells.

Nearly 700,000 bbl. of water has been injected into the Spraberry sand through the three injection wells on Atlantic's W. M. Schrock lease in Tract 34, Midland County, Texas, since the pilot project was launched in November 1952.

A reasonable estimate of the fracture space in the roughly 800-acre area, where increased fluid production has been noted, is established at 40 bbl. per acre, for a total fracture volume of about 32,000 bbl. Considering the small amount of accumulated water, 33,000 bbl., this means that about 635,000 bbl. or more of water, or 90 per cent total accumulated water injection of 700,000 bbl., has been imbibed into the Spraberry matrix.

The evidence of imbibition is clearly shown in Fig. 1, a map of Driver field including the area of the pilot project. The rough elipse at center encloses the 800-acre area which has been affected to some degree to date. The larger circle, emcompassing an area of roughly 16,000 acres, encloses that portion of Driver field—based on the 40-bbl. per acre estimate of fracture space—which would have been flooded had not imbibition taken place.

Northeast-southwest trend . . . There are 64 oil wells in the 5,440-acre project area. So far increases in oil production have been noted in 21 wells, and injection water is being produced in 11 wells and possibly in a twelfth (see Fig. 2).

As can be seen on this map, those wells which have shown increases in fluid production are located generally along a northeast-southwest line, indicating that Spraberry fractures in the area trend in this direction.

The three injection wells, Atlantic 3, 4, and 5 W. M. Schrock, form an isosceles triangle with a north-south base on the western half of Tract 34. Through an unexplained quirk, Atlantic 7 W. M. Schrock, located on the base of the triangle equidistant from each injection well and preselected as the key observation well for the experiment, showed absolutely no evidence of injected water or increase in oil production until recently and then only a relatively insignificant amount.

The first wells to show favorable

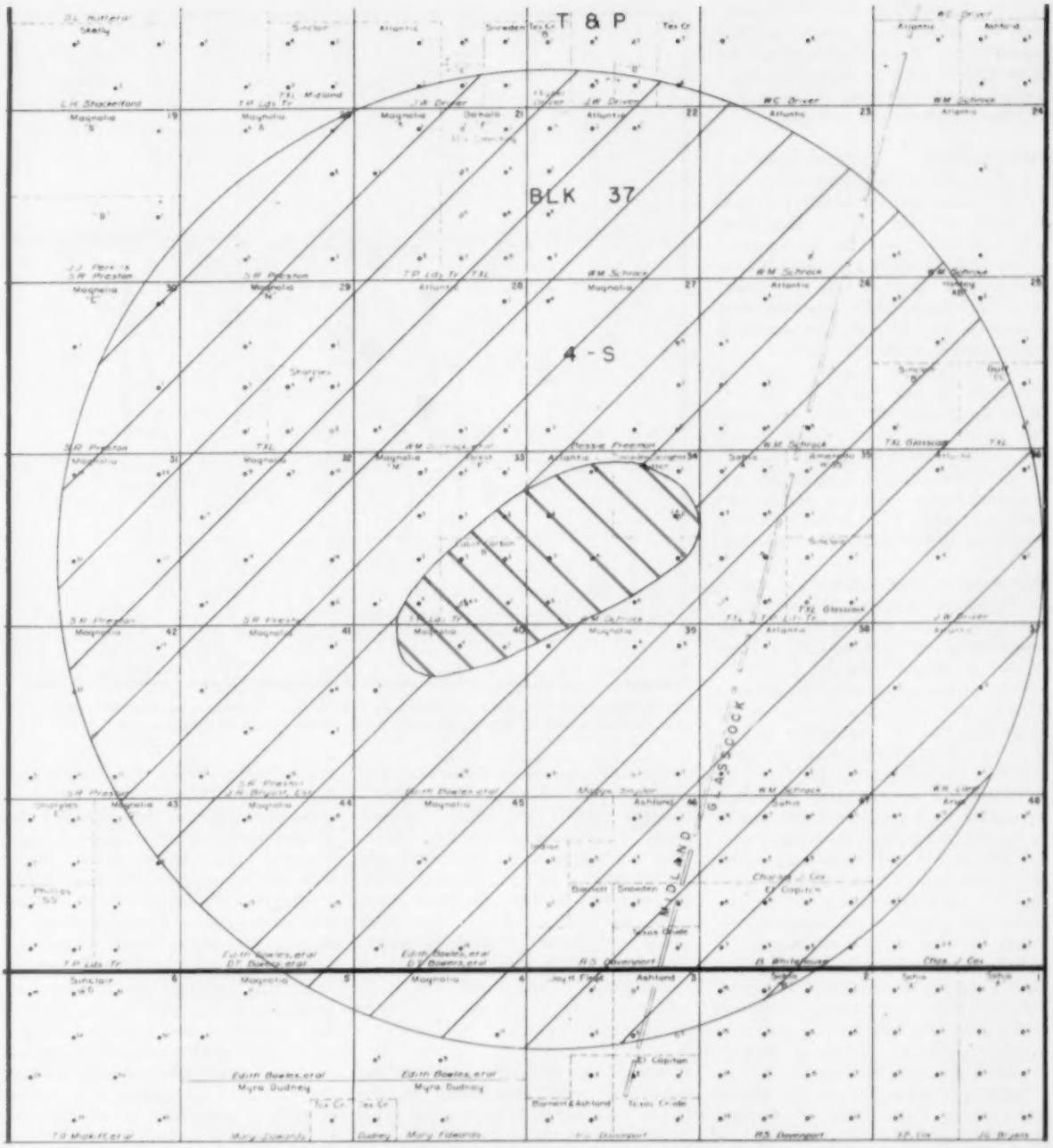


Fig. 1—The elliptical area at center is that which has been affected by water injection to date. The larger circle encloses the area which would have been flooded out, had not imbibition taken place.

changes in oil-production rates, which for the most part had been dropping at an alarming rate previously, were: Cabot Carbon "B" 1 TXL, James B. Snowden et al. "34" 2-A Schrock, and Magnolia Petroleum Co. 2 and 4 D. T. Bowles. Late in 1952 these wells either showed increases in oil production or began to level off from the previous sharp declines in producing rates.

Oil production from the following wells began to increase or level off from past rates of decline during 1953: Atlantic "34" 1, 2, and 6 W. M. Schrock, Cabot Carbon 2, 3, 4 TXL "B", James B. Snowden et al. "34" 1 Schrock, Magnolia 1 B. Freeman and 1 and 4 M. Snyder, Sohio 1 TXL "A," and Forest 2 TXL "F."

The flood front continued to move out gradually, covering the area shown in Fig. 1 by the middle of March 1954.

Well performance . . . Best performance to date has been by Magnolia 2 D. T. Bowles in Tract 40 directly southeast of 5 Schrock injection well.

In the 2½ months from the middle of September to the first of December 1952, production of this well slumped from 152 bbl. of oil daily to about 29 bbl. daily. Production increased erratically but steadily from the first of December on, and by the first of February 1954 was up to 78 bbl. daily (see Fig. 3). Gas-oil ratio dropped from 2,400 to 1 to 400 to 1.

The four Cabot Carbon TXL wells on the "B" lease in Tract 33 were

making a total of 50 bbl. of oil daily when the project was started in November 1952. Production declined to about 40 bbl. daily in December, then began a steady rise until the wells are now making about 100 bbl. daily.

Water injection . . . When water injection started in November 1952, two Schrock input wells were taking a total of about 400 bbl. daily. This total daily rate was increased to approximately 600 bbl. daily with the addition of the third injection well in January 1953. By May 1953 injection was boosted to the current rate which is approximately 2,100 bbl. daily.

History of the injection well is portrayed by the curve in Fig. 4. As is shown on the chart, no water was injected for about half a month in January. This was due to mechanical difficulties that shut down the engine and pump supplying water. The water is obtained from a shallow freshwater sand and filtered before injection.

How water is being imbibed . . . Oil in the Spraberry reservoir is stored in a very tight matrix, with virtually all the permeability concentrated in a large number of native fractures.

The fractures appear to be about 3 to 4 ft. apart and their average width is about 0.002 in., according to micrometer measurements made on cores by Sohio Petroleum.

Because of this fractured condition, oil cannot be forced from the matrix by means of conventional water flooding. Channeling and bypassing through the fractures would be extremely serious. The same channeling and bypassing would occur in gas injection and would be even more troublesome.

Atlantic conceived the idea that if these same troublesome fractures were filled with water, the natural capillary attraction of the fine pores in the tight matrix rock would imbibe or soak in the water from the fractures.

Early qualitative tests in the laboratory confirmed this theory. These tests involved submerging oil-saturated pieces of Spraberry matrix in water. As was suspected, water was imbibed and droplets of oil were forced out of the rock, rapidly collecting as globules on the surface of the sample.

The phenomenon is best understood by taking the case of a single fracture. As water is injected into the fracture and moves along the fracture, some of it is being lost continuously to the matrix by imbibition. As the water is soaked into the rock, oil is forced out, replacing the water in the fracture.

Other tests of the travel of water via imbibition into the Spraberry cores were run by the Atlantic research staff,

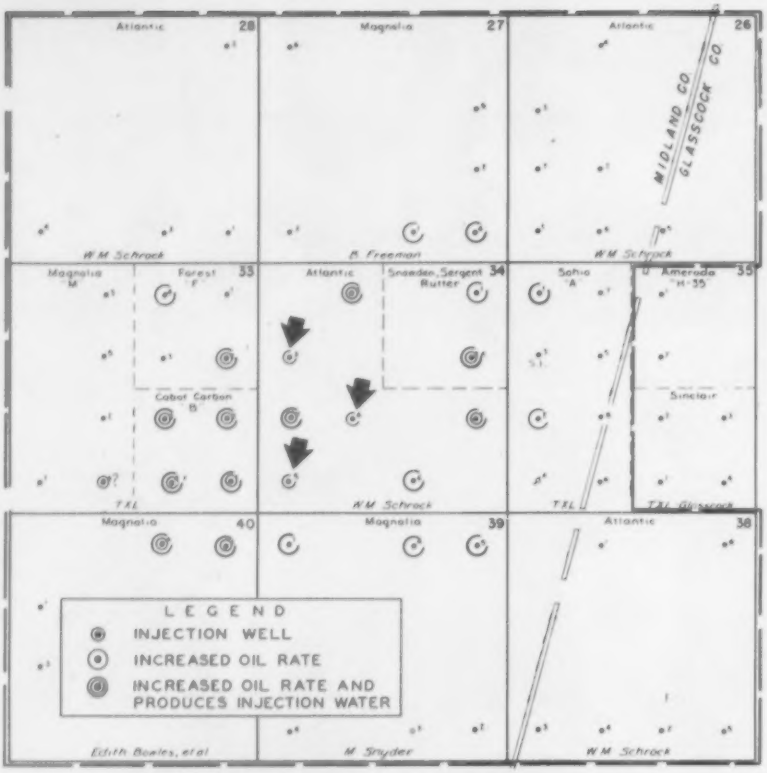


Fig. 2—Results of imbibition are shown on this Atlantic Refining map. Question mark indicates the well may be producing injection water. Arrows indicate injection wells.

using X-rays of cores which had been saturated with opaque phenyl iodide.

When results were adjusted to account for differences between laboratory and reservoir oil viscosities and the presence of free gas, connate water, etc., the tests showed that under Spraberry reservoir conditions the water would completely penetrate a matrix block 1 ft. thick within 6 months. It would even penetrate a block 6 ft. thick within 15 years, assuming 3-ft. penetration from two sides.

Future of the method . . . When the imbibition field experiment in the Driver area began in November 1952, Atlantic researchers calculated from laboratory test data that ultimate recovery might be about three times the natural-depletion recovery.

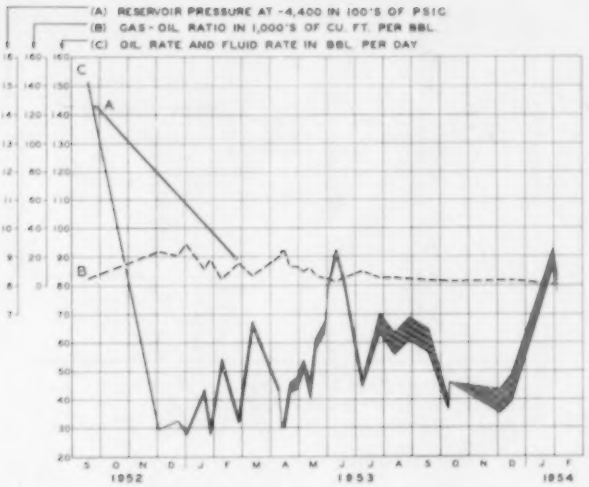
Atlantic engineers are being exceedingly cautious at present about throwing out predictions on how imbibition would work elsewhere and even in analyzing the encouraging results obtained so far in the pilot project.

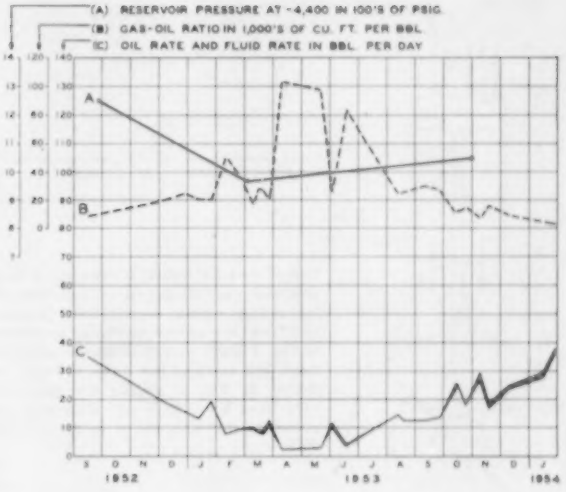
There are several reasons for this. The major one is that they cannot yet be sure just how much effect the Texas Railroad Commission - imposed shutdown of the majority of Spraberry wells from April through December 1953 had upon producing rates of the experimental wells—which were allowed to continue production.

Another reason is that Atlantic wants to compare its private analysis of results obtained in the Driver project so far with the opinions of the other major producers in the experimental area before coming to a final conclusion as to what the results mean. Representatives of Atlantic and the other major firms are currently sitting down together to do just that. If it is decided that results of the experiment merit, the project will undoubtedly be extended. Atlantic received permission of the Railroad Commission in December to carry on the project for another year.

Even though economics of Spraberry wells have improved somewhat by virtue of: (1) last summer's increase in the price of crude, (2) recent improvements in fracturing techniques, and (3) by the granting of permission by the Texas Railroad Commission early last year for 80-acre spacing, or even 160-acre spacing on approval of application to the commission, some method of extracting more oil out of the extremely tight Spraberry pay is badly needed.

It has been estimated that present production methods will recover only 7 to 10 per cent of the oil in place in the Spraberry.


(A) RESERVOIR PRESSURE AT -4,400 IN 100'S OF PSIG.
(B) GAS-OIL RATIO IN 1,000'S OF CU. FT. PER BBL.
(C) OIL RATE AND FLUID RATE IN BBL. PER DAY
1952
1953
1954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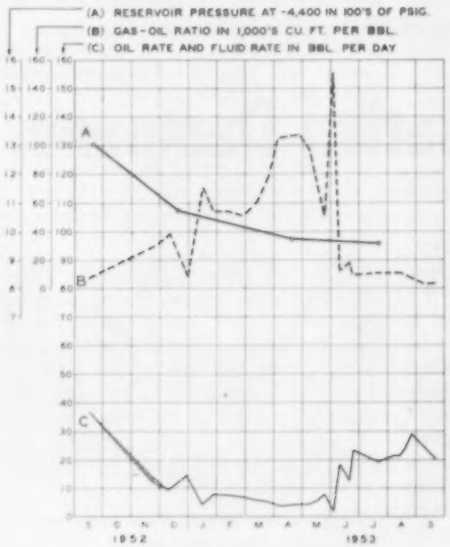
(A) RESERVOIR PRESSURE AT -4,400 IN 100'S OF PSIG.
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(C) OIL RATE AND FLUID RATE IN BBL. PER DAY
1952
1953

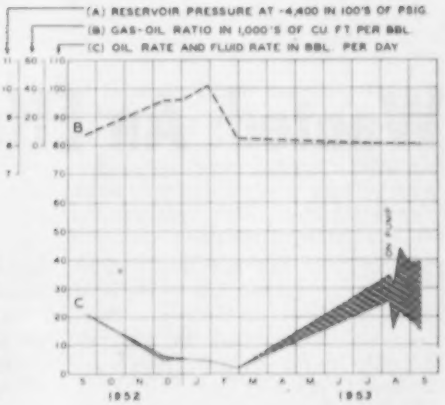

(A) RESERVOIR PRESSURE AT -4,400 IN 100'S OF PSIG.
(B) GAS-OIL RATIO IN 1,000'S OF CU. FT. PER BBL.
(C) OIL RATE AND FLUID RATE IN BBL. PER DAY
1952
1953

Fig. 3—Four of the producing wells and performance histories which have shown effects of nearby water injection. Upper left, Magnolia's 2 D. T. Bowles. Upper right, Magnolia's 1 Bessie Freeman. Lower left, Cabot Carbon 2 TXL "B." Lower right, Cabot Carbon 3 TXL "B."

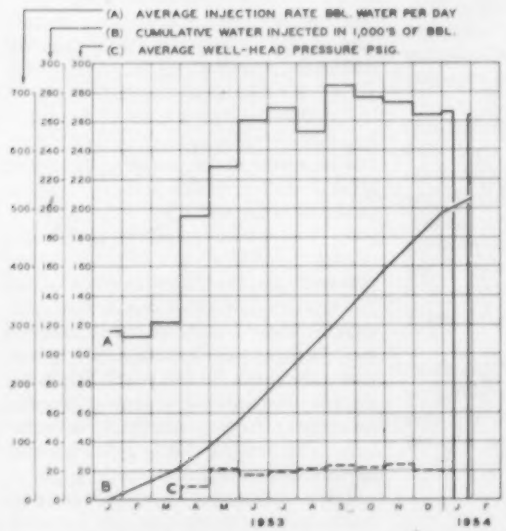
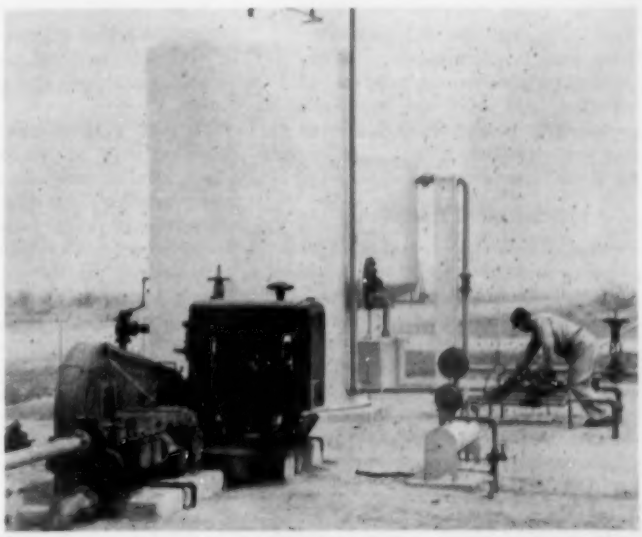
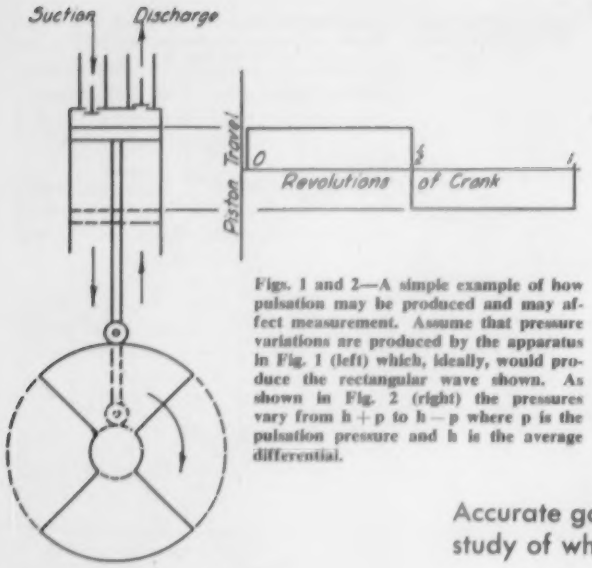
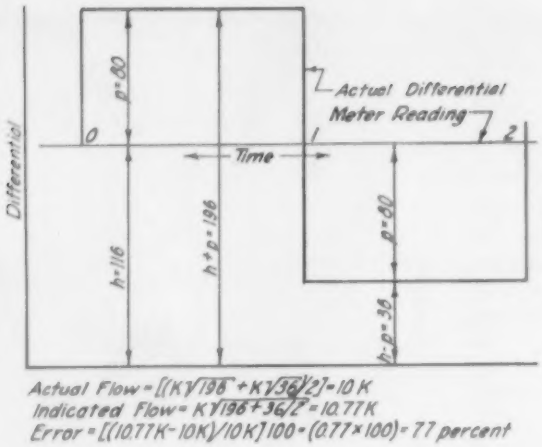

(A) AVERAGE INJECTION RATE BBL. WATER PER DAY
(B) CUMULATIVE WATER INJECTED IN 1,000'S OF BBL.
(C) AVERAGE WELL-HEAD PRESSURE PSIG.
1953
1954

Fig. 4—Atlantic's Schrock 34 No. 3 water injection well in Midland County, Texas, imbibition experiment.



Water-injection facilities for Atlantic's imbibition project in West Texas' Spraberry sand.





Actual Flow = $[(K\sqrt{196} + K\sqrt{36})/2] = 10K$
Indicated Flow = $K\sqrt{196+36}/2 = 10.77K$
Error = $[(10.77K - 10K)/10K]100 = (0.77 \times 100) = 7.7$ percent

Figs. 1 and 2—A simple example of how pulsation may be produced and may affect measurement. Assume that pressure variations are produced by the apparatus in Fig. 1 (left) which, ideally, would produce the rectangular wave shown. As shown in Fig. 2 (right) the pressures vary from h + p to h − p where p is the pulsation pressure and h is the average differential.

Accurate gas measurement is hampered by pulsative flow, study of which has long challenged engineers. Hence . . .

Wanted: An Effective Pulsation Dampener

by Eric J. Lindahl

PULSATION can have many detrimental effects, but one of the most serious of these is that readings of flow-measuring devices may be rendered absolutely invalid when the meters are subjected to pulsating flow.

Early studies of pulsation were associated with the measurement of steam supplying a reciprocating steam engine. Later erroneous measurement of air at the intake of reciprocating gasoline engines caused much concern. Measurement of air from fans was found difficult at times because of pulsation. Now there exists the difficulty of measuring fuels to gas turbines. And the reciprocating compressor with its pulsating flow and with the measurement problems it brings about has been in use, and promises to continue in use, for some time to come.

Nature of Pulsation

When flow is steady, that is, when the pressure and velocity remain constant at each point in the flow system, the normal energy equation can be used as the basis for determining the rate of flow through an inferential meter. However, when the flow is unsteady, that is, when there is a variation of pressure or velocity or both at the points of flow measurement erroneous results occur under the application of the steady flow equations.

In gas systems these variations in pressure or velocity or both can be caused by many devices but the chief offender is the reciprocating compressor. Other causes include undamped pressure regulators, clattering valves, and liquid surging back and forth in a low portion of a line. In recent studies with measurement of liquids it has been found that mechanical vibrations in the piping system cause phenomena similar to those observed with pulsating flow of gas. Whether mechanical vibration in gas piping systems creates pulsation errors is something that is not presently known.

To take a simple example of how pulsation may be produced and may affect measurement, assume that pressure variations are produced by the apparatus in Fig. 1 which, ideally, would produce the rectangular pressure wave shown. As shown in Fig. 2 the pressures vary from h + p to h − p where p is the pulsation pressure and h is the average differential.

To give an example how pulsation of this type may affect the reading on an inferential meter, first assume that the flow measured by the meter is given by the equation

$$Q = K\sqrt{h}$$

where

Q = the measured rate of flow,
K = a constant for the given meter,
h = the meter differential. Then, for the meter subjected to pulsating flow assume that during one period of time the actual differential is 196 units while during the next similar time interval the differential is 36 units, and that the recorder on the meter, because of its inherent inertia, indicates the average of the two actual differentials, or 116 units.

The actual rate of flow will then be

$$\frac{K\sqrt{196} + K\sqrt{36}}{2} = 10K$$

and at the same time the instrument will indicate a flow of

$$\frac{K\sqrt{196 + 36}}{2} = 10.77K.$$

This meter under pulsating flow then gives a reading which is

$$\frac{10.77K - 10K}{10K} \times 100 = 7.7$$

per cent greater than the actual flow.

This simplifies very much how pulsation causes erroneous meter readings but does give an indication why pulsation should not be tolerated. While the sample calculation just shown indicates an error of 7.7 per cent the actual error in a meter reading due to pulsation may be several hundred per cent.

Ideal rectangular, triangular, and sine waves have been analyzed for the maximum error which each can produce. Maximum error of approximately 40

Author is head of mechanical engineering department, University of Wyoming, Laramie. Paper presented before Operating Section, American Gas Association, New Orleans, March 4.

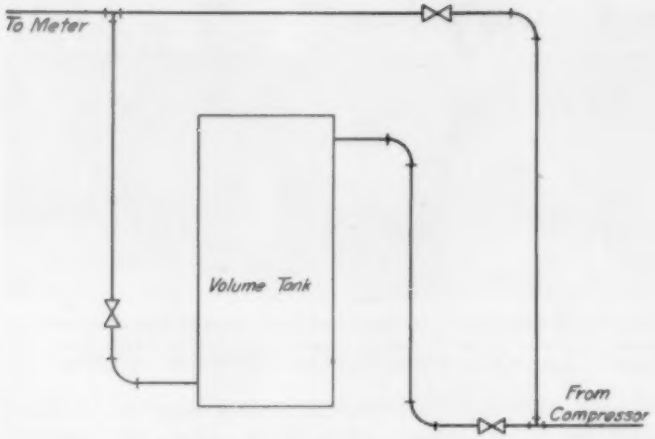


Fig. 3—Volume tank test arrangement.

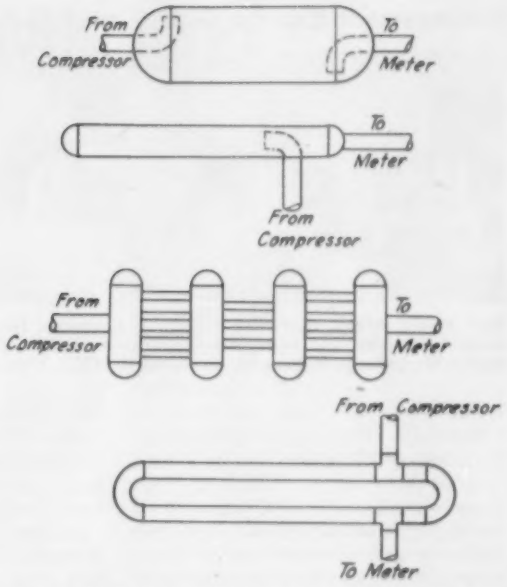


Fig. 4—Some of the devices used to minimize pulsation to a greater or less degree.

per cent was found in the rectangular wave. Since actual meter errors can be much greater than this perhaps it might be concluded that the actual pulsation waves are anything but regular. At least, this has been found to be the case in some instances where the shape of actual waves has been determined. Then, too, phenomena besides pressure variations enter into pulsation.

Nature . . . Some of the early studies were concerned with the nature of pulsation and a few theoretical investigations were made. For instance, it was found that for a given rate of flow the error due to pulsation was decreased if a smaller orifice was used and the differential was increased thereby. Another early study shows that restrictions placed in gage lines increased the meter error rather than decreasing it.

The study using the test setup shown in Fig. 3 and similar studies indicated that a volume placed in the line would tend to absorb pulsation. In this test the piping was arranged in such a way that the system could be operated both with and without the tank.

Other devices, a few of which are shown in Fig. 4, have been utilized and minimize pulsation to a greater or less degree.

Apparently any volume or anything that will produce a pressure drop when placed between the source of pulsation and the meter will tend to minimize the error due to pulsation. A pipeline between the two, if of some length, should eliminate pulsation and while it no doubt does in many instances there have been cases where lines of considerable length have not erased the pulsation.

Volume tanks placed between the source of pulsation and the meter have proved successful in some cases. But for some installations they would prove impractical because of the huge sizes that would be required. Commercially developed eliminators have proved successful and practical for the capacities and operating conditions for which they were designed but have been reported less successful when subjected to other than design conditions.

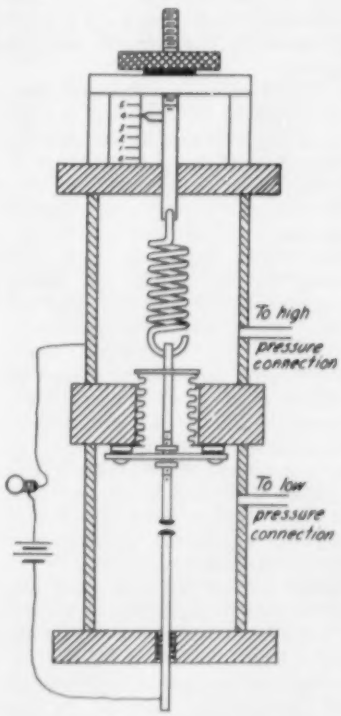


Fig. 5—Mechanical pulsameter used to determine the sum of the normal differential and the height of the peak of the pressure wave.

Restrictions consisting of a plate with single or multiple hole or perhaps merely a "pinched" valve placed between the offending pulsation producer and the meter conceivably might reduce the pulsation to the point where it is no longer serious. However, it appears that the determination of quantity of pinching or the optimum number and size of holes in a restrictive plate is largely a matter of trial and error at the present time.

Pulsameter . . . One device for determining whether or not pulsation exists is the Beitler-Overbeck mechanical pulsameter (Fig. 5) used to determine the sum of the normal differential and the height of the peak of the pressure wave.

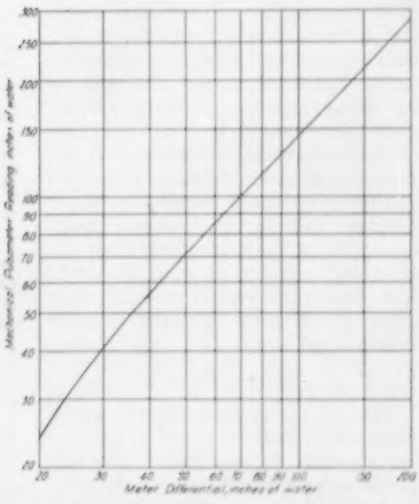


Fig. 6—Relationship between meter differential and pulsameter reading for 1 per cent error.

Measurement Experts Gather at A.G.A. New Orleans Conference

Prof. Samuel Beitler, Ohio State University, Columbus; Howard S. Bean, density and fluid meters section, mechanics division, National Bureau of Standards, Washington, D. C.; Pat H. Miller, Texas Eastern Transmission Corp., Shreveport; E. E. Stovall, Lone Star Gas Co., Dallas; H. B. McNichols, Columbia Gas System Service Corp., Columbus; F. C. Witting, Peoples Gas Light & Coke Co., Chicago.

Electronic devices have also been developed for detecting the presence of pulsation. In the mechanical device the reading from the instrument is compared with the differential indicated on the meter chart and from these two values a determination can be made which will indicate if the pulsation error is less or greater than 1 per cent.

This determination is made by the use of a curve (Fig. 6) which was established by tests using an experimental test setup handling natural gas. The setup consisted of two meters in series. One meter and the pulsameter were subjected to pulsation while the other meter had steady flow produced by considerable pinching of a plug cock placed between the two meters. The second meter thus gave true flow readings while the former gave erroneous readings and the extent of the error due to pulsation was determined. The line in Fig. 6 was drawn through the 1 per cent points which were determined by experiment.

While in former years most of the investigations regarding pulsation seem to have been largely of the "field" type, some of the most recent studies have consisted of mathematical analyses of the nature of pulsation and a little experimental work of a laboratory nature has been carried on. Most of the recent experimental work has not dealt with natural gas but any conclusions which can be drawn from any studies of pulsation should be of interest and prove applicable to the natural-gas industry. Nor has much recent experimental work been directed solely toward the solution of pulsation problems. Pulsation studies, however, have crept in and been incidental to other experimental work.

Future Work

There is a general feeling that special attention should be given to each of the variables present in a meter subjected to pulsating flow such as quantity of flow, frequency of pulsation, amplitude of the pulsation wave, the wave form, the diameter ratio, the meter differential, and perhaps others. It would be determined which of these have a marked effect on the meter accuracy and which do not.

In time it might be possible to write a coefficient into the steady flow equation to correct for pulsation.

Curve check . . . Another study that could well be carried on in the laboratory, is the one which would check the 1 per cent curve used with mechanical pulsameter and to establish the precise location of this curve in the region of low differentials. While the 1 per cent curve for this instrument was determined in a setup designed specifically for this study it was not possible to change all the variables and the instrument should be given a thorough check by changing all possible conditions.

At the risk of being overly optimistic the statement is ventured that this instrument might be used for determining the magnitude of the pulsation error if sufficient studies were carried out with the instrument operating under various frequencies, wave forms, amplitude, etc.

Some studies should be made with pulsating liquids. While the matter of pulsating liquids probably does not concern people who deal exclusively with natural gas, nevertheless, some laws governing pulsating flow may be discovered which could be carried over into pulsating gas flows. Actually tests made with liquids or vapors may be easier to conduct and the accuracy may be greater than tests conducted with gases since vapors (after being condensed) and liquids can be weighed to determine the true rates of flow.

Further studies for both gases and liquids should be undertaken with mechanical vibrations introduced into the piping system. One study of this nature was begun but had to be abandoned before completion. Whether or not enough research was done to justify any conclusions is not known.

Code changes . . . A feeling exists that eventually codes should be formulated which would define the maximum amount of pulsation permissible which would still permit accurate measurement with the aid of inferential meters. So far there exists only the feeling that measurement with primary elements should not be undertaken if pulsation is present and that pulsations can be suppressed by capacity and resistance placed between the source of pulsation and the meter. At present, no general rule seems to exist for determining just how much capacity or how much resistance should be introduced to suppress pulsation to the extent that it is no longer harmful.

While it is generally known that a critical pressure drop between the pulsating source and the meter will eliminate pulsation that is indeed an expensive way of eliminating the trouble and no doubt something less than a critical drop will suffice. Perhaps a research project might well be devoted to determine just how much of a pressure drop is actually necessary for various capacities, frequencies, wave forms, etc.

Research should be carried out to check the validity of some of the theory which has been propounded from time to time. For instance, use has been suggested of the Strouhal number which relates orifice diameter, pulsation frequency, and flow velocity to determine if and when a meter is subjected to excessive pulsation.

Further time probably could be well spent in additional study of the application of the Hodgson number to the design of volumes for absorbing pulsation. This number relates specific volume of the fluid, its pressure, the pressure drop between the pulsation source and the meter, pulsation frequency, the flow rate, and the volume in the system between pulsation producer and meter.

Bibliography

A paper, "Pulsating—Flow Measurement—A Literature Survey," by Oppenheim and Chilton presented at the 1953 annual meeting of the American Society of Mechanical Engineers contains seventy references related to pulsating flow.

When Do Dual Completions Pay?

Generally when . . .

- Two marginal zones can be combined
- Otherwise uneconomic zone may be opened
- Maximum production is achieved early through decreased development time
- Offset obligations on marginal zones may be fulfilled
- Savings in steel and development costs are obtainable

by Marshall C. Turner

WHILE we may not apply to dual-zone wells all of the production methods applicable to single-zone completions, the range of techniques practical with dual completions is substantially enlarged by recent development of new tools and equipment. Dual-zone completions do not have indiscriminate application; they offer considerable savings in development costs if producing and reservoir characteristics indicate that the desired production rates can be efficiently produced after cessation of natural flow.

The degree of success in artificially lifting fluid from a dual completion will be dependent upon designing the casing and completion program to fit anticipated production requirements.

During recent years the rate of dual completing has been accelerated principally as the result of mounting development costs, plus the necessity for finding an economic means of recovering oil and gas present in zones of small reserves.

There is no reason to foresee a downward trend in this program, for as drilling gets deeper and more expensive, zones which cannot support a reasonable return for the drilling of a single-zone completion may become economical if they can be included in dual completions.

The advantages of dual-zone wells are based principally upon those economic factors related to development costs, and may be summarized as follows:

1. Two marginal zones, neither of which would support single-well development, may be combined to provide a profitable dual completion.

2. Otherwise uneconomic zones may be opened for production in an existing well.

3. Maximum production is achieved at the earliest possible date through decreased development time.

4. Offset obligations on marginal zones may be fulfilled.

5. Considerable savings in steel and reduced development costs are obtainable in comparison to drilling separate wells.

Some operators have completed dual-zone wells with the objective of reverting to a single completion at the time one zone ceases to flow. Thus a marginal stringer which would not otherwise be produced, and for which artificial lifting equipment cannot be justified, is opened to production for a period of time with resultant increase in oil recovery from the property. There are also instances of dual completions on leases having no offset wells where one zone is temporarily abandoned when it ceases to flow. It is returned to production as a single completion at the time the other zone is depleted and can be plugged.

It is a relatively simple technique to produce dual-zone oil wells wherein both zones are flowing. In time, formation pressures decline, natural flow ceases, and it becomes necessary to lift fluid from one or both zones by placing adequate lifting equipment within the confines of a single string of casing.

Zone isolation methods . . . In initial completion methods where both zones are brought in flowing, zone segregation and type of flow courses can be summarized as follows:

1. A single packer between zones. Either single, parallel, or concentric tubing strings may be employed.

2. Two packers, one above each zone. As above, single, parallel, or concentric tubing strings may be used.

3. A parallel tubing string packer employed in conjunction with either of above two methods.

Figs. 1 through 7 are schematic illustrations of packer and flow systems which may be employed.

Single packer . . . Fig. 1A illustrates a type of packer commonly employed which may be set either by wire line or run on pipe. The tubing string is equipped with a sealing nipple which provides the seal between zones when inserted into the packer. The packer may be equipped with a bottom clapper valve which closes when the tubing is raised; thus each zone may be swabbed in separately by raising or lowering the tubing.

A latching device is available for locking the tubing to the top of the packer should this be desirable where high differential pressures may exist. In this installation, the upper zone must flow through the annulus and the lower zone through the tubing.

Fig. 1B shows details of a side-door choke which can be placed in the tubing string for increased flexibility of operations. By running the proper choke on a wire line the side port may either be closed or opened; thus drilling fluid may be circulated out and both zones brought in together.

The upper zone may be shut in and the lower zones brought in separately. Each zone may be fractured or acidized separately—the lower zone through the tubing, and the upper zone through the casing.

Figs. 2 and 3 indicate parallel and concentric flow systems feasible with the single packer. These installations offer the possibility of longer flowing life for the upper zone by eliminating the necessity for flow through the relatively larger area of the casing annulus.

In Fig. 2 the parallel strings are clamped together and run simultaneously. Concentric strings afford some advantage in that the inside string may be pulled separately, leaving the larger tubing in place.

These installations are easily converted to straight gas-lift systems, particularly for the upper zone. Either the casing annulus or one of the tubing strings may be used for gas supply.

Author is with Phillips Petroleum Co., Bartlesville, Okla. Paper presented at A.P.I. Mid-Continent district meeting, Oklahoma City, March 19, 1954.

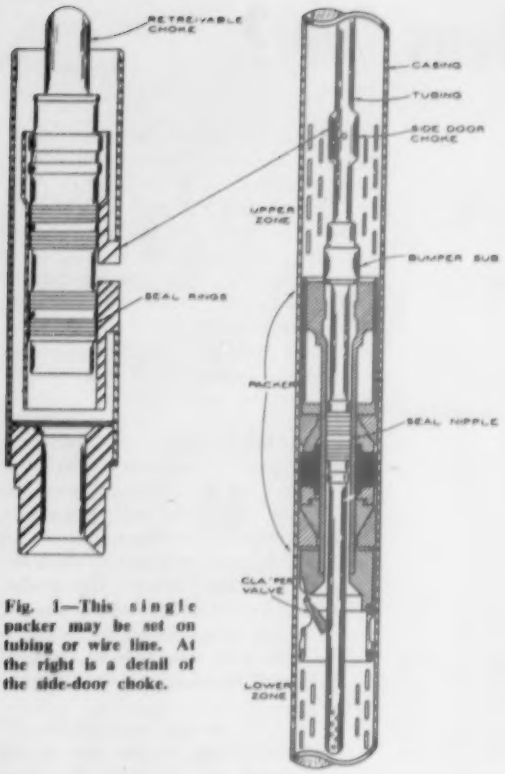


Fig. 1—This single packer may be set on tubing or wire line. At the right is a detail of the side-door choke.

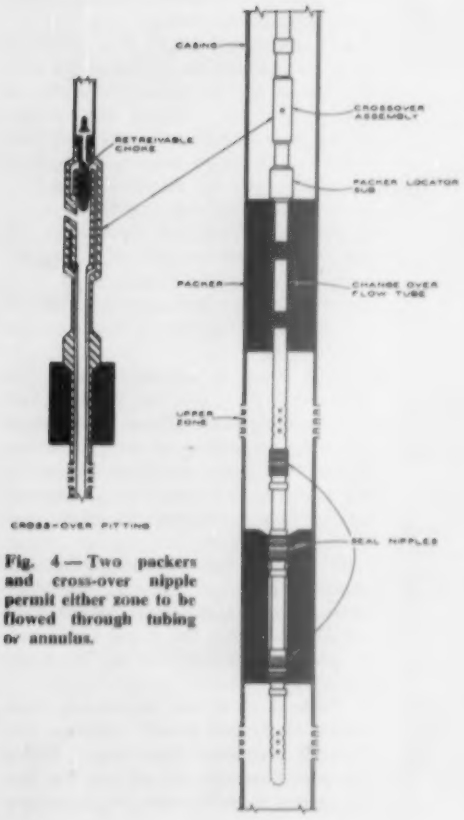


Fig. 4—Two packers and cross-over nipple permit either zone to be flowed through tubing or annulus.

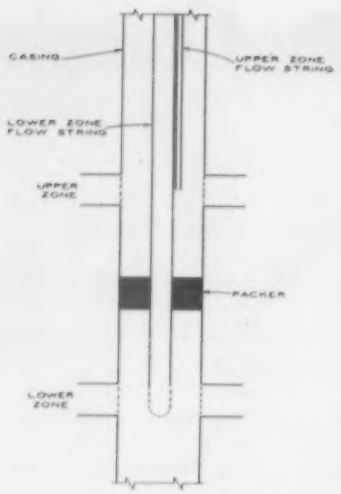


Fig. 2—Parallel tubing strings eliminate the necessity of one zone having to flow through a big-area annulus in a one-packer system.

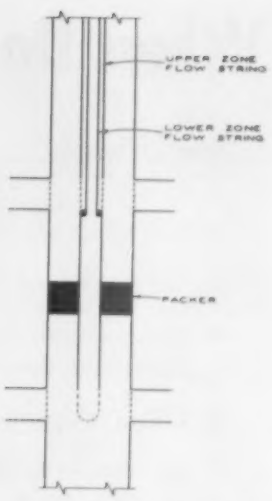


Fig. 3—Concentric tubing strings also cut down the cross-sectional area of flow when one packer is used.

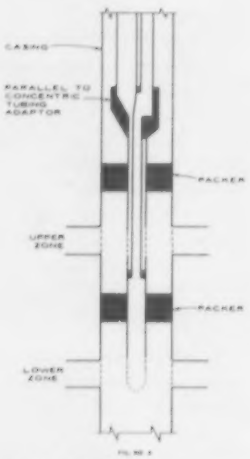


Fig. 5—Parallel tubing strings for use with two packers.

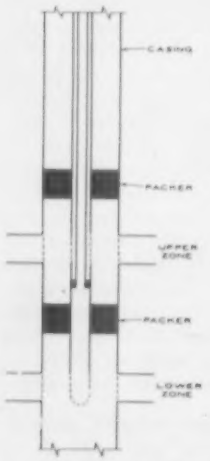


Fig. 6—Concentric tubing strings with packers above both zones.

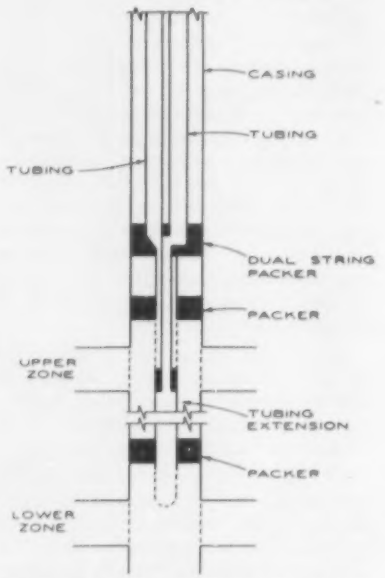


Fig. 7—This dual completion employs a dual-string packer.

Two packers . . . Fig. 4 illustrates the installation of one packer above each zone. Both packers may be permanently set, or in some instances, operators use a retrievable-type packer above the upper zone. This system provides a high degree of flexibility with the addition of selective flow courses installed in the tubing string. Concentric tubing extensions project below the top packer to keep the zones separated. Chokes can be inserted into the cross-over assembly by wire line to allow separate flow of each zone through either the tubing or casing annulus. These flow reversals can be made at any time without killing the well.

In this illustration the lower zone

flows through the center tubing extension and is diverted into the casing at the crossover nipple. The upper zone flows through the tubing extension annulus and into the tubing string. Either zone can be shut in: either zone may be fractured or acidized through the tubing, and each zone can be swabbed in separately through the tubing. If one zone stops flowing, pumping equipment can be installed in the tubing to pump fluid within the limitation imposed by lack of gas-oil separation.

Figs. 5 and 6 show parallel and concentric tubing string installations using single packers and seal nipples above each zone. Since the casing annulus is not required as a flow course, these systems provide the advantage that mud may be left in the casing should formation pressures make this desirable. Here again, the parallel strings are run simultaneously, while in Fig. 6 the inside tubing string may be retrieved separately. Both systems may provide longer flowing life since neither zone is required to flow in the annulus.

Use of the two concentric strings with two packers has not received wide application because of lack of flexibility in handling the upper zone. It cannot be swabbed in separately unless the smaller tubing is pulled and the lower zone shut in. Bottom-hole upper-zone pressure tests are difficult to obtain. The zones are commingled when the inside string is pulled.

Parallel tubing string . . . Fig. 7 is a schematic diagram of a dual completion with parallel tubing strings and a dual string packer. This packer is a retrievable type, run on the tubing. In this illustration the dual-string packer is shown added to a completion employing a retainer packer above each zone. The dual-string packer may be used with a single packer completion, replacing the upper retainer packer shown. The zones are handled separately at all times, and either zone can be swabbed or killed without interfering with production from the other. This system lends itself for conversion to a number of artificial lifting methods.

Artificial Lift

The above systems described for control of dual-zone flowing wells satisfy the requirements for operation of flowing production. As previously mentioned, to justify a dual completion we must be assured of being able to efficiently produce the desired rates from cessation of natural flow to the well's economic limit. In the production of wells by artificial lifting methods, the majority of wells will require techniques which permit maximum removal of back pressure on the formation in order that desirable production rates will be maintained.

The period in the life of a well at which this factor becomes important depends principally upon reservoir characteristics and allowables. A well which ceases to make its allowable is immediately a candidate for an improved production method and the simplest way of increasing fluid entry into the well is by a reduction of back pressure on the formation while producing.

In some instances, we may be able to gas-lift or plunger-lift dual zones for several years, possibly until one zone reaches its economic limit and the well can be reverted to a single producer. In the majority of wells, these methods offer only intermediary techniques and as formation pressures decline, greater producing drawdowns are desired. To date, bottom-hole pumps provide the most effective means of achieving this pressure drawdown. An essential requirement of an oil pump installation

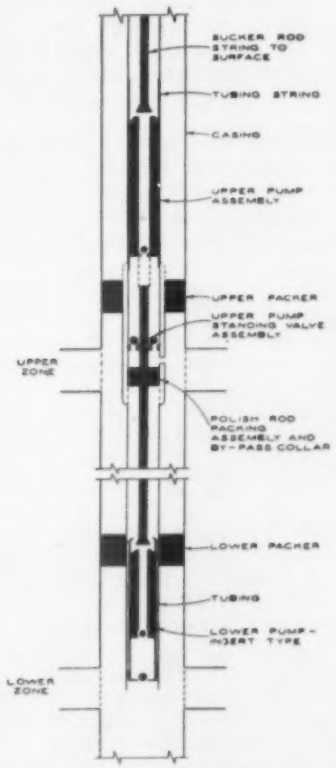


Fig. 8—A dual completion where both zones require artificial lift by a dual-zone pump.

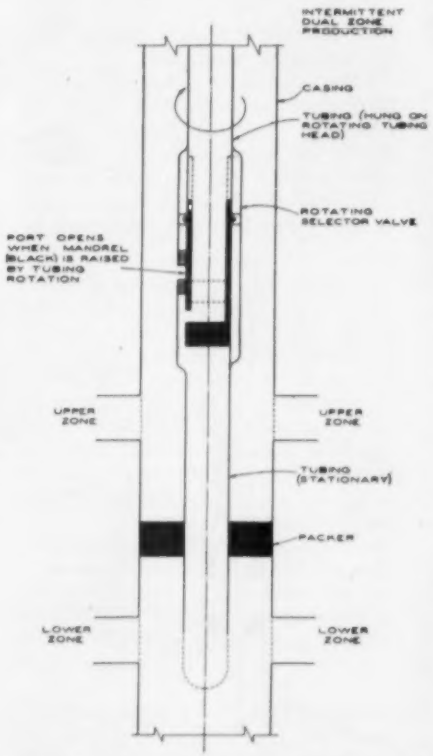


Fig. 9—Only one zone at a time may be pumped with this arrangement. It will eventually restrict production.

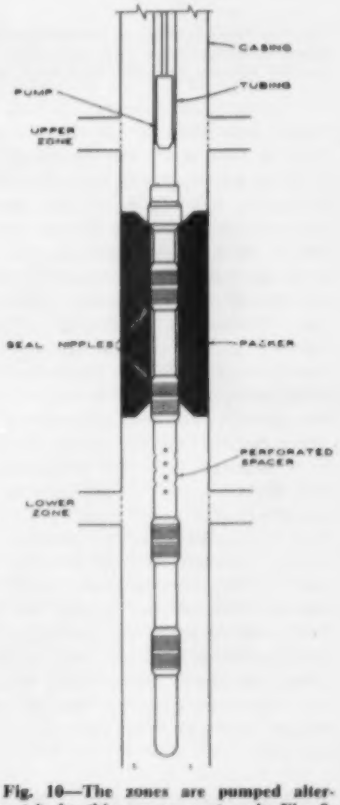


Fig. 10—The zones are pumped alternately by this arrangement as in Fig. 9; the entire tubing string must be raised here.

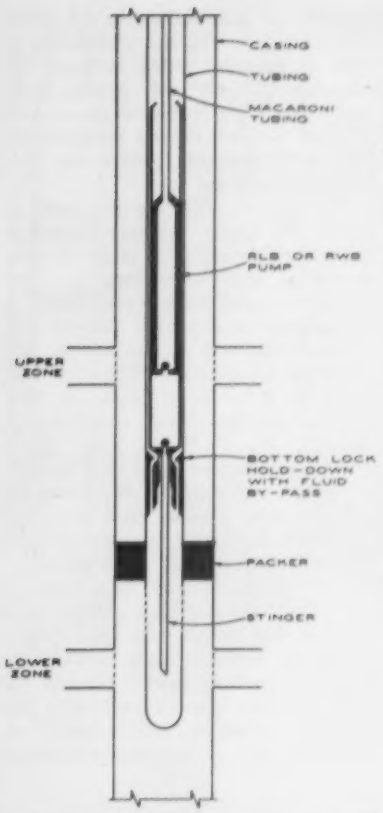


Fig. 11—Fluid is pumped through the small-diameter tubing string while gas rises in the annulus between the large and small tubing.

is the separation of gas from the oil prior to fluid entry into the pump.

These two concepts, i.e., gas-oil separation in the well bore, and bleeding of gas at the surface with resultant removal of back-pressure on the well, form the fundamental requirements of an oil-well pumping system. These are the requirements which are at present limiting greater use of existing dual-zone pumps. Effective production with these pumps is limited to wells of very low gas-oil ratios since all produced gas must pass through the pump bore. Nor is it believed that the withdrawal of gas from below a packer can be achieved simply by running a small-bore tubing string to the surface. The tubing will tend to load up with fluid and will not function as a gas-oil separator. The solution appears to be in being able to pump the producing fluid level sufficiently below the packer in order that the casing annulus becomes the separation reservoir and the small tubing then provides an escape for the gas.

Reservoir fixes technique . . . For a single-zone well, under the ideal situation, reservoir characteristics should be the sole determinants in establishing the production technique. Given the production and decline rates, gravity, gas-oil ratio, formation pressure, and P.I. data, we can establish whether the well should be gas-lifted, intermitted, operated with a plunger lift, or a hydraulic or rod pump installed. However, the situation is seldom ideal and our choice of equipment is affected by such factors as proration schedules, existing lease facilities, cost of equipment, and competitive conditions. When, in addition, we introduce considerations relative to dual-zone completions, we find additional factors which will affect our choice of production equipment.

The fluid-lifting methods to be used will determine the number and sizes of tubing strings to be run, which in turn will determine the size of casing to be employed. Therefore, one cannot overemphasize the need for anticipating production equipment requirements for the entire life of a dual-zone well prior to establishment of a drilling program.

This point is illustrated in Table 1 which shows some of the considerations necessary when contemplating a dual-zone well. In this example the upper zone is to be pumped from 7,300 ft., and the lower zone is a gas distillate zone which it is known will flow to its economic limit. Various pumping methods are listed for the upper zone, together with accompanying flow courses for the lower zone.

Other choices of pumping installations could be included to make the list more complete; however, those shown are representative of displacements available for the condition outlined, and will serve to illustrate the necessary considerations. Referring to Table 1 these considerations are outlined below.

1. What minimum size flow course can be used for the lower zone? For the rates to be produced, will excessive back-pressure on the formation result if a 1-in., 1¼-in., or 1½-in. tubing string is used? Will the lower surface pressure resulting from the smaller tubing string affect the gas sale price? If larger than 1½-in. tubing is required we can immediately eliminate No. 1, 4, 7, 8, and 9 as possible installations.

2. What will be the gas-oil ratio of the upper zone? Will it be so low as to permit efficient pump operation without gas withdrawal from below the pump? If bottom-hole gas separation is necessary, Nos. 2, 3, and 5 are eliminated. If it is believed that the upper zone can be successfully pumped from below a packer a greater range of pump displacement is available; however, in considering pump operation without gas separation it is believed production rates should be based on pump efficiencies lower than the 70 per cent indicated.

3. What peak rod stress can be tolerated? Will corrosion be present so as to restrict rod loads to possibly 24,000 psi. or can a 28,000-psi. stress be allowed? This consideration will considerably affect obtainable production rates should rod pumps be employed.

4. What is the maximum fluid rate to be produced from the upper zone? The rate obtainable will have to be estimated in the light of the above factors.

With answers to these questions the type of equipment indicated and the casing size required become evident. For example, if it is assumed that 200 bbl. per day are required from the

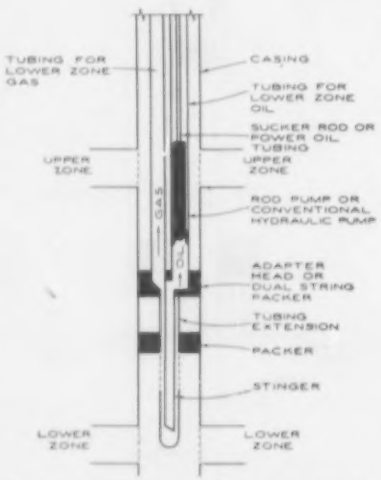


Fig. 12—Gas from the lower zone does not pass through pump but through separate parallel tubing.

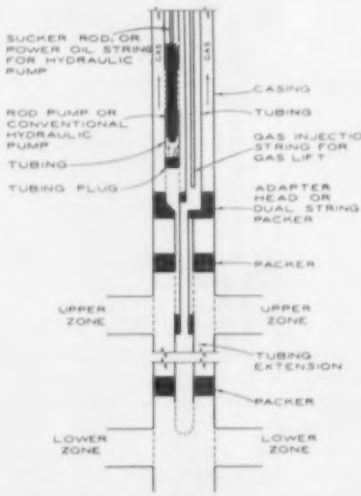


Fig. 13—A variation of the system of Fig. 12, with the upper zone being pumped.

TABLE 1—SUBSURFACE PRODUCTION EQUIPMENT FOR PROPOSED DUAL COMPLETIONS

(Conditions: Upper zone; depth 7,300 ft.; fluid to be produced with bottom-hole pump. Lower zone; depth 7,500 ft.; gas distillate zone will flow to economic limit.)

No.	Lower zone flow courses	Upper zone tubing	Pumping method	Upper zone gas-oil separation in casing possible	Top rod size (in.)	Est. pk. rod stress, psi.	Pump size (in.)	Pump s.p.m.	Est. max. prod. 70 per cent P.V.E. bbl./day
			For 5½-in. (17-lb.) Casing						
1	1-in. EU	2-in. EU	74-in. stroke beam	Yes	⅞	28,000	1¼	10	60
2	Casing	2½-in. EU	120-in. stroke beam	No	1	28,000	1¼	10	130
3	Casing	2½-in. EU	300-in. stroke hydraulic	No	1	32,600	1¾	5½	360
4	1¼-in. Hyd. Ca	2-in. Hyd. CS x ¾-in. EU	Conventional hydraulic pump, 60-in. stroke	Yes			2 x 1½	10	*115
5	Casing	2½-in. EU x 1¼-in. EU	Conventional hydraulic pump, 24-in. stroke	No			2½ x 1¼	71	245
			For 7-in. (23-lb.) Casing (In Addition to All Above)						
6	2-in. EU	2-in. EU	74-in. stroke beam	Yes	⅞	28,000	1¼	10	60
7	1½-in. EU	2½-in. EU	300-in. stroke hydraulic	Yes	1	32,600	1¾	5½	360
8	1½-in. EU	2½-in. EU x 1¼-in. EU	Conventional hydraulic pump, 60-in. stroke	Yes			2½ x 1¾	18	270
9	1-in. EU	3-in. EU x 1¼-in. EU	Conventional hydraulic pump, 24-in. stroke	Yes			3 x 1½	64	425

*250 psi. loss in ¾-in. tubing.

upper zone with gas-oil separation below the pump, and at least a 2-in. flow string is needed for the lower zone, we are forced to use 7-in. casing and are limited to a long-stroke hydraulic pumping unit or a bottom-hole hydraulic pump.

In general, the operator who has completed a number of dual zone wells with 5½-in. casing faces serious obstacles when artificial lift is required for one or both zones. Seven-inch pipe offers the minimum internal diameter which permits installation of two 2-in. tubing strings, and this advantage greatly increases the possible combinations of production equipment which may be utilized.

Minimum casing . . . Economic justification for 7-in. casing seems apparent for dual oil-zone completions unless it is known that one zone will flow to depletion through small tubing without substantial sacrifice of production. Experience indicates that the additional completion cost for completing a well with 7-in. pipe instead of 5½-in. will carry from approximately $5,000 for a 6,000-ft. well to $16,000 for a 10,000-ft. completion. A single well-servicing job on one of these wells may exceed this difference.

Dual-zone wells completed with 7⅝ or 8⅝-in. casing offer more room with which to work but the limitations are essentially the same as in 7-in. pipe. If by reason of drilling a dual completion, larger than 7-in. pipe is required in comparison to drilling twin wells with 5½ or 7-in. casing, the economic advantages of dual completions diminish. Whereas, contractors will frequently drill the same hole size for 5½ and 7-in. casing (8¾ in.), 8⅝-in. pipe will usually require an 11¼-in. hole or larger and the cost differences for both drilling and material take a substantial increase.

In 5½-in. casing . . . There are several methods which are applicable to dual-zone wells completed with 5½-in. casing. By using parallel tubing strings or by running small-diameter tubing in conjunction with the equipment described in Figs. 1 through 7, various means of gas lifting can be devised for one or both zones. Gas-lift valves can be incorporated with parallel or concentric tubing strings and the casing annulus used for gas supply. A number of such systems are in operation. The plunger lift must not be overlooked as a means of increasing flowing life or, under proper conditions, as a method of gas lift.

The problems of applying gas lift to dual completions are not complicated; however, the eventual and more difficult requirement will be to pump one or both zones. An installation which has become common practice is the addition of a sucker-rod or hydraulic pump to the equipment illustrated in Fig. 4. A pump is seated in the tubing above the crossover assembly to pump one zone. The other zone continues to flow through the casing annulus, or is gas-lifted by means of a small-diameter parallel tubing string. This is a relatively simple installation, and its success will depend largely upon the extent to which the zone can be pumped without providing below pump gas-oil separation.

Two-zone pump . . . Fig. 8 illustrates the working principles of a dual-zone pump. The essential parts are the upper pump and lower pump assemblies connected together by a polished rod traveling through a packing assembly. The lower pump may be any conventional insert type which will pass through the barrel of the upper pump. The upper pump is an intricately designed assembly in which a polish rod is fastened to the bottom of the plunger, and the standing valve must be placed in the annular space around this rod. The upper pump working barrel, bypass collar and packer, and lower pump seating shoe are made up on the tubing. The remaining pump equipment is run in on the rods. Fluid from the lower pump flows up the tubing, bypasses around the packoff and upper standing-valve assemblies, and is discharged into the casing annulus above the top packer. The upper zone is pumped through the upper pump and fluid flow is through the tubing. Since the operating speed is the same for both pumps, displacement differences may be obtained by variations in plunger sizes.

Fig. 9 shows another approach at pumping two zones, with the addition that gas-oil separation is possible in the upper zone. This method utilizes a rotating selector valve. It is essentially a side-door choke, operated by rotation of the tubing. With the mandrel in the upward position, the lower zone is closed off and the upper zone is pumped as a single-zone well. With the mandrel in the lower position (as shown), the upper zone is shut in and the lower zone is open to the pump. When the lower zone is being pumped, all produced gas must pass through the pump. The length of time a zone is pumped will depend upon the frequency necessary to achieve the desired average daily rate from each zone. As some operators have experienced, it is not al-

(Continued on page 127)

Coastal plants find ways to improve maintenance

by F. Lawrence Resen

A NUMBER of on-the-job modifications have been made at The Chicago Corp.'s three plants in South Texas which illustrate how improved operations and lower costs can result by ingenious approaches to plant maintenance problems.

At Chicago's Wardner, Coastal, and Gulf Plains plants, the changes included improved cooling-tower operation, simplified gas-engine maintenance, replacement of cast-iron valve seats in gas-engines with brass seats, and an improvement in anchor bolts used to tie down gas-engine compressors.

Cooling unit . . . A serious pressure drop developing in the cooling units for the incoming wet gas was licked by one of these on-the-job improvisations at the Gulf Plains plant.

The problem was caused by changing field conditions which found more gas entering the plant than under original design conditions. Although the water supply was ample to provide sufficient cooling effect, the problem could not be solved simply by the addition of more coolers since the space in the cooling tower was limited.

The cooling units were three-pass horizontal units with the tubes exposed to water spray within the cooling tower. Incoming gas would enter a header and be diverted through the upper rows of tubes by means of a partition in the header. The gas would be cooled by water on its first pass through the upper tubes and upon reaching the other (outgoing) header would make a return pass through the center rows of tubes, being separated from the lower row by a partition in the outgoing header. A third pass would then be made through the lower rows of tubes and the gas would then pass through a second cooling unit before entering the processing area. With two of the units being in series and the large volumes of gas being handled, the pressure drop across the cooling tower reached alarming proportions.

The solution was effected by converting the cooling units from three-pass to single-pass, still maintaining the two in series and still providing the same cooling surface. However, by eliminating the several passes, the pressure drop declined considerably. A drop from 111 psi. to 20 psi. was effected on one set of units and another drop from 25 psi. to 6 psi. effected on a second set.

The conversion was accomplished by drilling three 2½-in. holes in the partitions in both the incoming and outgoing header in each of the cooling units. Incoming gas now enters the header and passes through all tubes simultaneously in a single pass. The gas then makes a similar single pass through the second unit in series before entering the processing area.

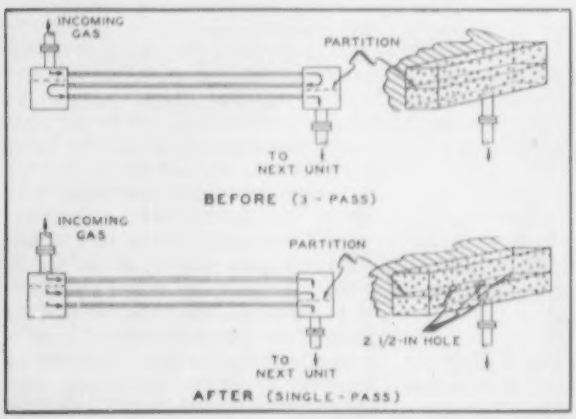
The modification provides the necessary cooling effect without any substantial pressure drop developing across the cooling units and at a fraction of the cost as compared with an enlargement of the cooling-tower structure or a second cooling-tower installation. Chicago engineers checked with the manufacturer prior to proceeding with the modification to insure that the three holes in the partition would not seriously weaken the headers.

Gas-engine compressor . . . A simple modification to a gas-engine compressor has cut down the maintenance time and manpower required in one particular operation.

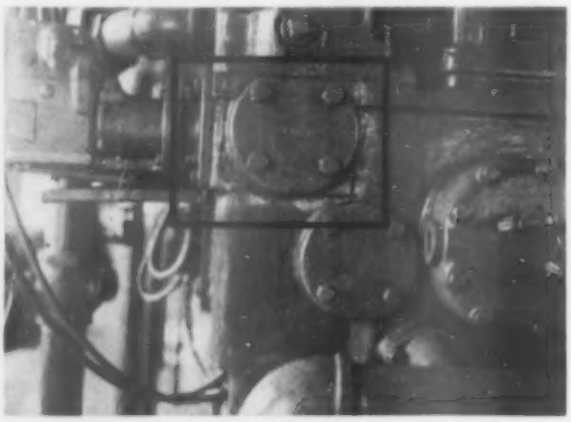
On the unit in question, a gear drive in the upper portion of the engine housing is used to drive the oil pump, governor, magneto, and lubricator. An inspection plate permits this drive to be checked to determine if it is performing properly, but whenever a bearing requires replacement, or some other work has to be done such as replacing broken cams, a major job used to be the rule.

It would be necessary to approach the gear drive by first pulling the air valves and cam shaft to get into the unit. Such a job would require about four men and require many hours of labor just in removing the valves and shaft and replacing them.

To simplify getting into the unit, a section was cut out of the housing of the engine large enough to permit repairs to be carried out on the items discussed. The section of housing cut out was just slightly larger than the inspection plate end and the actual cutting took place just around the in-



Pressure drop was reduced by decreasing number of passes in cooling units.



This access hole for gas-engine-driven compressor facilitates minor repairs.

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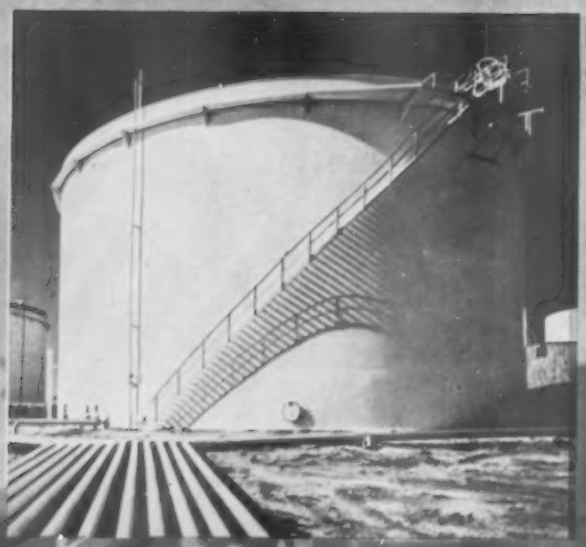

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spection plate. This was done by drilling four small holes, threading them, and then using a thin blade, cutting the housing from center to center of each of the holes in the shape of a square. Screws are made up into the threaded holes to keep the cut plate in position during normal operating times.

The access hole available allows a gear puller to be inserted within the main unit and also permits component parts to be removed and replaced without any major work. It also provides enough working room to permit maintenance man to tighten set screws in the near vicinity as required. One man can normally make the necessary repairs.

A gasket may be easily made for the cutout housing if desired, but since only a small amount of oil spray gets up to the plate it is not usually necessary. Location of modification is high in the frame and doesn't contribute any structural weakness to the engine.

Valve seats . . . Difficulties inherent with cast-iron valve seats in air valves on gas engines at The Chicago Corp.'s Wardner plant have been eliminated by substituting a brass seat in the original housing.

Previously, the cast-iron seat, which was cast as part of the housing, would become rusted and pitted and prevent the engines from being started. It would then be necessary to get a complete new housing and replace the housing with the defective seat. The steel valves also had a tendency to stick in the iron seat which contributed to operating difficulties.

A change over was made wherein brass valve seats were machined to specifications and soldered into the housing in place of the cast seats. The brass, which is quite resistant to condensate corrosion, has been providing trouble-free operation. In addition to improving the performance of the engines, it has eliminated the costly replacement of complete housings. Now as wear occurs, it is merely necessary to insert a new brass seat in the original housing at a fraction of the previous cost.

Anchor bolts . . . The replacement problem of broken anchor bolts has been considerably simplified at the Coastal plant.

Breakage of anchor bolts due to the vibrational effects of operating units is quite common throughout the petroleum industry and requires a major maintenance job when large-size gas-engine compressors are involved.

Maintenance work can be cut down to a bare minimum if a procedure developed by Chicago is followed:

1. When the next broken anchor bolt requires that the foundation around the anchor bolt be chipped away, remove all of the anchor bolts.
2. Cut the unbroken bolt in two equal parts and thread the ends.
3. Select one of the halves as the new foundation bolt and then make up a nut on this bolt and weld it so that it will not come loose.
4. Weld a second nut to the first one.
5. Make up the other half of the bolt in this nut and then use the entire unit as the anchor bolt in making up a new foundation for the compressor.
6. Replace the compressor in position, and secure.

When any future breakage occurs, which usually happens just below the nut holding the compressor in place, the upper section of the anchor bolt is merely backed off and a new one made up without the need of breaking into the foundation.

An additional hint to cut down the vibrational effects is to insure that excess threads on the anchor bolt are ground off. Occasionally, the bolts will be received completely threaded and if the unneeded threads are removed they will not be able to cut into the surrounding concrete.

Gasket seats . . . A power-driven tool used at the Coastal plant can be effectively used to true up gasket seats in the heads of coil bundles.

The tool is machined out of a stand-

Chicago Corp. personnel made this power-driven tool to true up gasket seats.

ard piece of bar stock, with one end machined down to fit into the chuck on an air drill and the other end machined to fit into the size tube involved. A removable cutting blade is located just behind the shoulder on the tube end of the tool. This blade is held in place by a set screw and may be removed for sharpening.

The tube end of the tool is inserted into a tube after it has been rolled so that the tube can guide the cutting bar. With an air motor, it requires just a moment to true up the gasket seat and an entire head can be finished in a relatively short time.

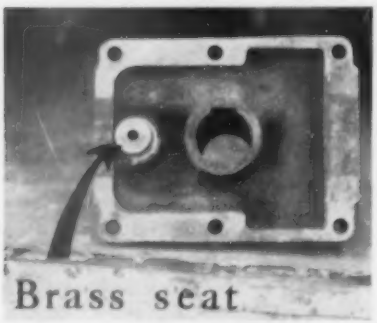
The tool was devised when it became necessary to clean gasket shoulders around more than 2,800 tubes.

Propane . . . The availability of propane around a gasoline or cycling plant should not be overlooked in maintenance work.

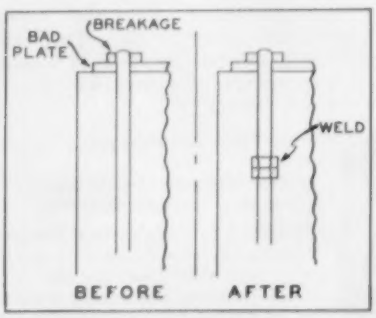
At the Coastal plant, propane has been used effectively to simplify the replacement of wrist pins on pistons.

The wrist pins are secured with a lock nut-pin arrangement so that they will not move when a compressor is operating. It is a simple matter to knock the lock pins out when removing the wrist pins, but replacing them is a different matter. The wrist pin has to be perfectly lined up before the lock pin —with closed tolerances—can be inserted.

This can be simplified by using propane as a refrigerant to shrink the pin. The shrinkage will be such that the pin will be actually free to turn when inserted through the wrist pin. Once this is done, the expansion of the lock pin as it returns to the ambient temperature will both line up the wrist pin perfectly and also lock it in place.



Brass valve seat on this cast-iron housing makes possible seat replacement without having to dispose of entire housing.



By cutting bolt in two equal parts and welding nuts as shown the problem of replacing anchor bolts is simplified.

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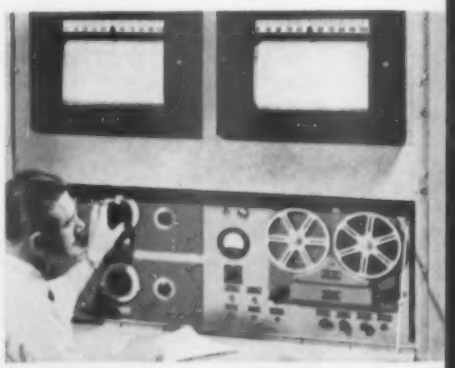

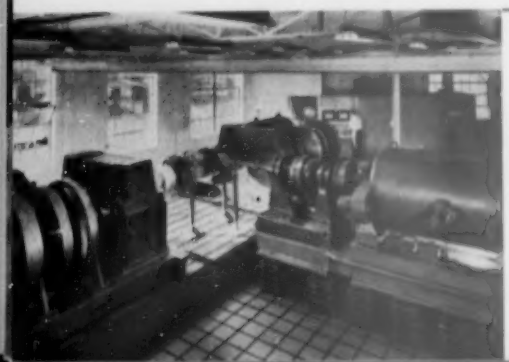

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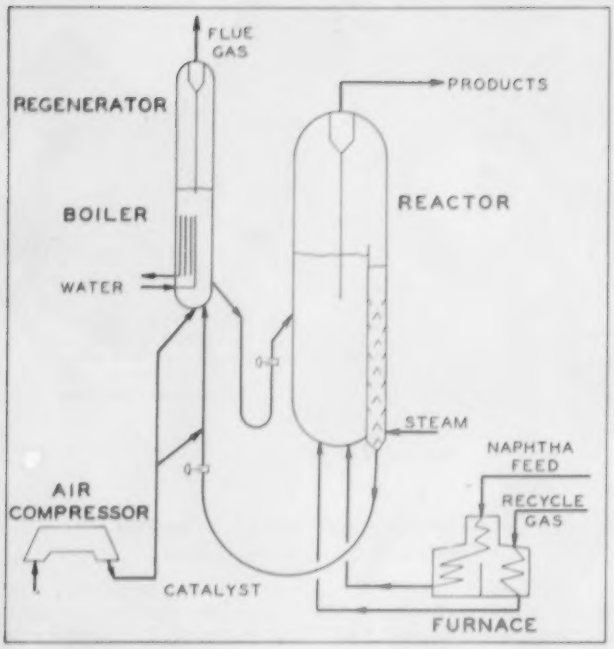

Fig. 1—Model I fluid Hydroformer.

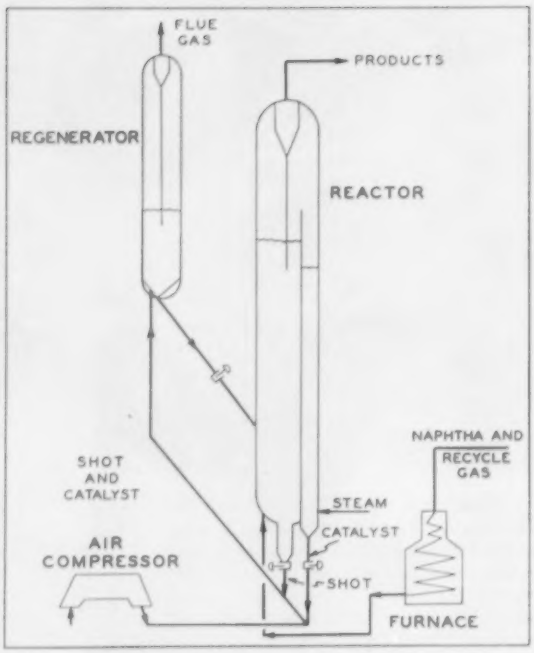

Fig. 2—Model II fluid Hydroformer.

Model II Fluid Hydroformer Uses

Shot-Catalyst Principle

by C. W. Tyson, E. W. Nicholson, and E. J. Gornowski

THE Model II fluid hydroformer is similar in most respects to the Model I process. The reforming reactions take place in an isothermal fluid bed of molybdena catalyst, the catalyst being continuously recycled between the reactor and the regenerator.

The distinguishing feature of the Model II fluid hydroformer is that it has one more source of heat supply than the Model I process. This new heat source is an inert solid stream which circulates with the catalyst between the reactor and regenerator, and which conveys into the reactor the heat of regeneration which cannot be transported economically by the catalyst itself.

The most obvious material to circulate would be an inert substance similar in particle size to the catalyst itself. There would be no problems in catalyst flow, and none in processing, if the material were entirely inert. However, the entire catalyst-handling system would have to be increased in size in proportion to the diluent added.

In regard to lines, this would be no great hardship, but the doubling or tripling of vessel size would be excessively costly. This problem was solved by choosing an inert material more dense than the catalyst, and also of larger size. The material has been referred to as "shot."

Advantages . . . The unique features of the shot-catalyst system which make its use advantageous in a fluid process such as hydroforming are twofold, as follows:

- The shot will settle through a fluid bed of catalyst at a relatively high velocity. As a result, the shot holdup in the reactor and regenerator beds is low even though the rate of shot recirculation is many times that of the catalyst. Therefore, the reactor cost is only slightly affected by the use of shot.
- It is possible to control independently the rate of shot and catalyst withdrawal from the reactor. This can be done either by withdrawing separately a shot and a catalyst stream from the reactor, or a single stream of the desired shot to catalyst ratio.

The fact that shot and catalyst together can convey all of the available heat of regeneration into the reactor results in a considerable reduction in the heat required from the recycle-gas stream. Investment savings in compression, furnaces, heat exchangers, cooling water, and power are realized. In addition, a lower recycle-gas preheat temperature permits combining the naphtha feed and recycle gas so that all of the preheating can be done in a single train of exchangers.

Another feature of the use of shot is that the flexibility of the already flexible fluid process is increased. This arises from the ease with which a Model II unit of a given design can handle variations in carbon yield which might occur, for instance, from changes in feed stock. This results because the available heat from regeneration is con-

Authors are associated with Esso Laboratories. Tyson and Gornowski are with Standard Oil Development Co., Linden, N. J.; Nicholson is with Esso Standard Oil Co., Baton Rouge, La. Paper presented before midyear meeting, A.P.I. division of refining, Houston, May 13, 1954.

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stant for a given air rate, and because all of this heat is conveyed to the reactor.

If a feed stock is used which would result in a higher carbon yield than that used for design, the catalyst rate is reduced below design values, thereby compensating for feed quality. The shot circulation rate is increased so that the heat conveyed to the reactor is maintained at a constant value.

Model I vs. Model II

Table 1 presents a comparison of the principal operating conditions of Model I and Model II fluid hydroformers. In both cases the conditions are optimum when a 250° to 325° F. West Texas virgin naphtha is fed and reformed to produce a 92 research octane number C_{5+} gasoline without TEL addition. The significant difference between the two operations is that the Model II process requires only about 40 per cent of the recycle-gas rate necessary in Model I.

Furthermore, the Model II recycle-gas preheat temperature is 1,000 °F., compared with 1,200° F. for Model I. Moreover, the lower gas rate results in a 40 per cent higher space velocity for Model II.

Figs. 1 and 2 are schematic flow plans of Model I and Model II fluid hydroformers. The principal differences to be noted in Model II are that the feed streams are preheated together and no regenerator cooling is required. In the Model II case the reactor is smaller, and the bottom of the vessel is designed to permit separation of shot from catalyst.

Laboratory-scale studies . . . Exploratory studies of the flow characteristics of shot-catalyst mixtures were made in glass equipment under atmospheric conditions. Other work in connection with the inertness and attrition qualities of shot was done in a ½-bbl. per day fluid hydroforming unit and in other special laboratory equipment. A summary of the results of the exploratory work is presented hereinafter.

The flow characteristics of shot-catalyst mixtures are complex but, for illustrative purposes, they can be likened to an aqueous slurry wherein the shot behaves as the solid and the fluid bed of catalyst as the liquid. Using this analogy, the greater part of the fluid bed would behave as a constant-rate settling zone and a relatively small volume at the bottom of the bed as a compression zone.

The attrition characteristics of shot-catalyst mixtures were studied not only by a standard roller attrition test and by circulating the solids through a glass transfer line at plant velocities, but also by actual operations, in a ½-bbl. per day hydroformer. All of these tests indicate that the rate of shot attrition is very low, and that the rate of catalyst attrition is not measurably changed by the presence of shot.

The effect of shot on process performance of molybdena catalyst when hydroforming was studied in a ½-bbl. per day fluid hydroformer. The results of these tests indicate that the presence of shot had no significant effect on catalyst performance. Shot leaving the reactor with the spent catalyst contained no carbon.

Pilot-plant studies . . . The results of the laboratory glass unit and ½-bbl. per day plant studies on mixtures of catalyst and shot indicate that large-scale operations of a two-solids system would be feasible. However, before commercial design of such a plant was undertaken, it was felt desirable to demonstrate the operation on a large pilot-plant scale.

The demonstration was designed to provide an over-all integrated operation of a two-solids system at actual hydroforming conditions. It also made possible the obtaining of sound engineering and design data taken during actual operations on equipment similar in type, if not in size, to projected commercial equipment.

TABLE 1—HYDROFORMING OF A 250° TO 325° F. WEST TEXAS VIRGIN NAPHTHA TO PRODUCE A 92-OCTANE NUMBER (A.S.T.M. D 908, RESEARCH METHOD) C_{5+} GASOLINE WITHOUT TEL ADDITION

	Process: Model I	Model II
Reactor:		
Pressure, psig.	200	200
Temperature, °F.	895	900
Recycle gas—		
Rate, cu. ft. per bbl.	4,700	2,000
Preheat temperature, °F.	1,200	1,000
Naphtha—		
Preheat temperature, °F.	1,000	1,000
Solids circulation, lb. per lb. of naphtha feed:		
Catalyst (catalyst-to-oil ratio)	1.0	0.6
Shot (shot-to-oil ratio)	None	3.1
Regenerator:		
Pressure, psig.	200	200
Temperature, °F.	1,125	1,125
Cooling-coil duty, B.t.u. per lb. of feed	100	None
Air standard, cu. ft. per bbl. of feed	541	685

The pilot-plant demonstration was carried out in the 50-bbl. per day fluid hydroforming pilot unit at Baton Rouge. This plant was originally designed as a Model I unit, and had been used to provide the final demonstration of the basic soundness of fluid hydroforming. The 50-bbl. per day plant was converted to a Model II design by modifications to the reactor, regenerator, and solids-transfer lines. In this pilot plant the catalyst and shot were transferred from one vessel to the other in admixture through single transfer lines. As mentioned previously, it is also possible to withdraw the catalyst and inert solids from separate parts of the vessel, as shown in Fig. 2.

The mixed-solids type of transfer was chosen for the pilot plant because it provided some simplification of control, and it would determine whether there were any solids-flow problems occasioned by the use of mixed-solids streams.

The over-all results of the pilot-plant demonstration of the Model II design were extremely gratifying. There were no serious problems associated with circulation of the shot-catalyst mixture. Control of operating and process conditions was excellent. The pilot plant was operated as a Model II unit, with shot and catalyst circulation for 70 days. About one-half of this time was devoted to operational and engineering studies. Extensive process data were also obtained.

The rapid settling of shot through fluid catalyst beds was clearly demonstrated in the pilot-plant operations. For example, when the combined shot-catalyst stream entering the upper part of the pilot-plant reactor contained 3 lb. of shot per pound of catalyst, the average concentration in the dense catalyst bed below the shot inlet point was only 0.1 lb. of shot per pound of catalyst. Although the shot settled rapidly in the low-velocity reaction vessels, no problem was encountered with separation of shot in the standpipes or high-velocity transfer lines.

The circulation of the shot in the pilot plant had no discernible effect on process results. Process data were obtained in the pilot plant during consecutive periods with the same feed stock and operating conditions, with and without the circulation of shot. The feed stock used and typical yields obtained during this operation are shown in Table 2.

The 50-bbl. per day pilot-plant demonstration proved the basic soundness of the Model II design under actual process conditions, and made possible the sound design of commercial plants which utilize the Model II principle.

TABLE 2

50-Bbl.-Per-Day Model II Fluid Hydroformer —Feed Stock and Typical Yields

Feed: 210° to 375° F. South Louisiana Naphtha; Gravity, 54.4° A.P.I.

Yields on Production of 95-Octane-Number (A.S.T.M. D 908, Research Method) C_{5+} Gasolines, Per Cent on Feed	
C_{5+}, per cent by volume	80.6
C_4, per cent by volume	5.8
Dry gas, per cent by weight	9.5
Carbon, per cent by weight	1.1

Equipment and Investment Required

A comparison of the major equipment requirements for the two types of hydroformers is listed in the following tabulation. The basis for comparison is as shown in Table 1, and on a 22,200-bbl. per stream day scale.

Design	Model I	Model II
Compressor, b.hp.:		
Air	3,100	3,900
Recycle	2,400	800
Total	5,500	4,700
Furnaces, total heat absorbed 10^6 B.t.u. per hour	125	75
Heat-transfer, surface, sq. ft.	50,000	32,000
Reactor steel, lb.	620,000	380,000
Utilities—reforming section:		
Consumption—		
Power, kw.	4,900	3,200
Cooling water, g.p.m. per minute	5,900	5,100
Steam, net lb./hr.	1,500	5,100

The lower recycle-gas required in the Model II plant results in the generally decreased process requirements shown in the foregoing tabulation. These are principally economies in compression and heat transmission. The small increase in air compression for Model II is based on economic balance considerations, and shows that a somewhat higher carbon yield can be justified when all of the available heat from regeneration can be used in the reactor.

The reactor-steel saving results from the decreased recycle-gas rate, in that a higher catalyst activity is attained and a vessel of smaller cross-section may be used. The lower power requirements for Model II reflect the smaller recycle-gas compression load. Less cooling water is needed because less recycle gas is cooled.

Cost estimates which have been made indicate that the equipment savings for Model II result in a reduction in investment of 15 to 20 per cent over the Model I design. Operating costs are correspondingly lowered by 7 to 10 cents per barrel of feed.

Present Status of Fluid Hydoforming

It will be recalled that the principal process advantages of fluid hydroforming are as follows:

1. Octane ceiling higher than for other processes.
2. No limitation in feed stock end point.
3. High-sulfur feeds can be reformed without the use of desulfurization equipment.
4. Good yields of gasoline, especially when higher paraffinic feeds stocks are reformed.
5. Cracked stocks can be reformed with good selectivity.

At the present time 127,000 bbl. per day of fluid hydroforming capacity is under construction or is operating in the United States and throughout the world. These units are of the Model I design.

In addition to the advantages cited previously herein, the lower investment and associated lower operating costs make the Model II hydroformer a superior means for increasing the value of heavy naphtha. It is anticipated that new fluid hydroformers will use this type of design.

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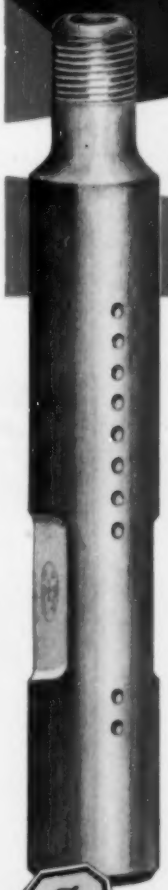

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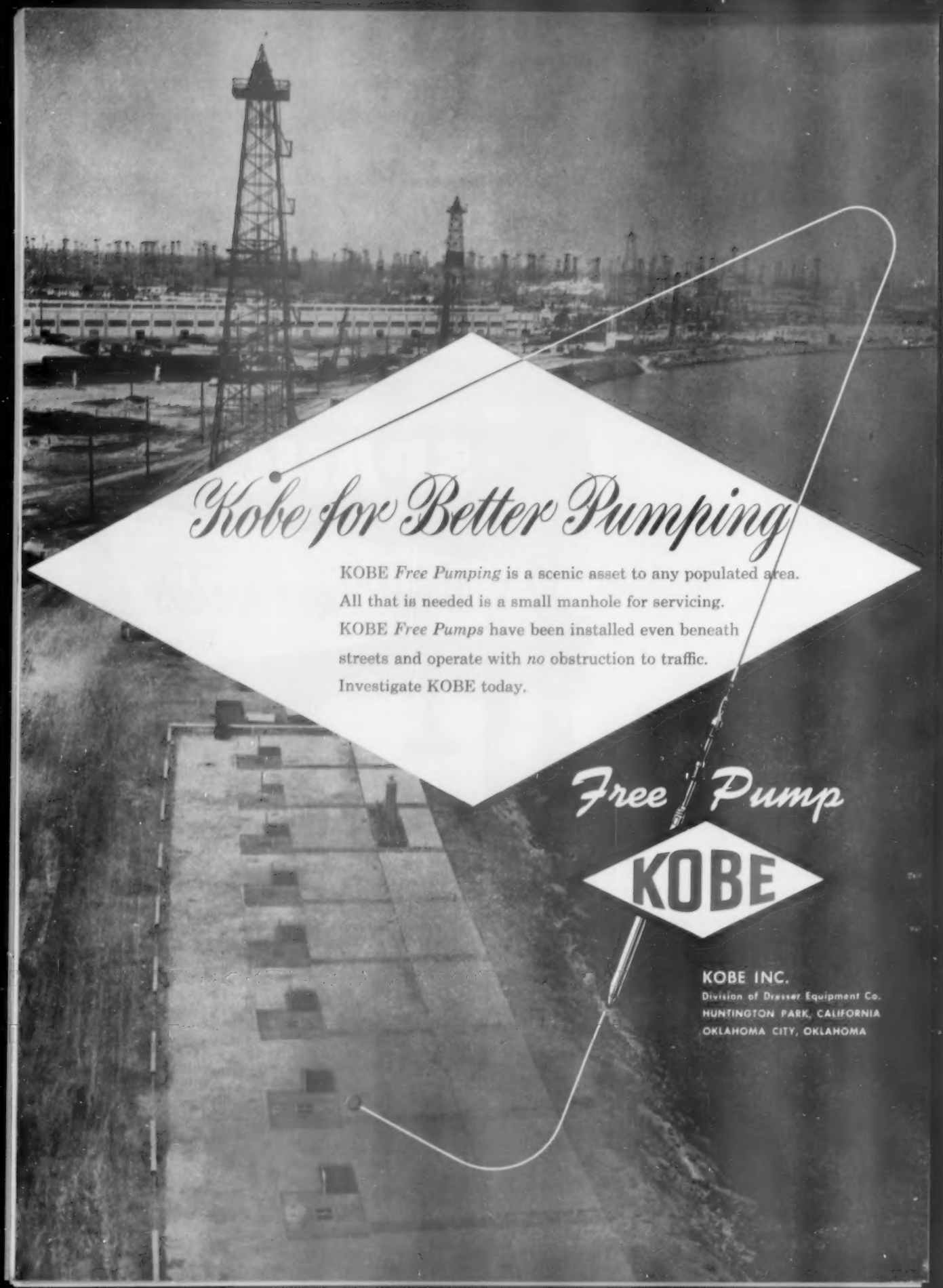
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When Do Dual Completions Pay?

(Continued from page 115)

ways possible to make an allowable in 15 days and the time cycle between rotations has to be shortened. Eventually production will be restricted by this system.

Fig. 10 illustrates another method which is used to pump alternately two zones in wells of moderate depths. This entails raising and lowering the entire tubing string so that the perforated nipple between the seal nipples is open to one zone at a time. The use of this hookup of course requires a casing head with packoff features which will provide a seal while the tubing is raised and lowered. Some operators have installed surface hydraulic lifting equipment to facilitate raising and lowering the tubing. Here again production rates are restricted when full-time pumping is necessary to produce the desired rates.

Tubing as sucker rod . . . Fig. 11 illustrates a method of pumping which has been applied to single completions of shallow to moderate depths; however, the author is unaware of any instance where this equipment has been used in dual completions. It has possible application where it is necessary to remove the gas from below a pump without using the casing annulus. An insert pump is run on small-diameter tubing which is used in place of sucker rods. Fluid passes through the pump plunger directly into the small tubing through which it is pumped to the surface. A bypass around the pump holddown seating ring allows the well fluid to rise in the annulus between the large and small tubing, and agitation caused by the motion of the small tubing helps to separate the gas which escapes to the surface.

This method, if used in conjunction with parallel pumping strings, might provide gas separation systems for each of two pumps in the same well bore.

For dual-zone wells completed with 7-in. casing instead of 5-in., there is available a much larger number of combinations of lifting equipment. Of course, all of the systems previously discussed as applicable in 5½-in. pipe are also feasible in 7-in. casing, with the advantage that greater capacity equipment can be installed.

Fig. 12 exemplifies a proposed system where one 2-in. string provides a flow course for lower zone gas and the other 2-in. tubing provides the lower zone pumping string. The upper zone may be flowing, or a third, small-diameter, string may convert the casing annulus to a gas-lift system for the upper zone.

A parallel string adapter head may be substituted for the dual-zone packer; or if both types of packers are installed as shown, the tubing extension may be perforated between the two packers to enable better gas-oil separation.

Fig. 13 illustrates a variation of the preceding installation. The upper zone is discharged into the casing annulus above the dual string packer. Gas separation takes place in the casing and a pump placed in one tubing string provides a standard pumping installation. The lower zone flows through the other tubing; or it may be gas lifted by running in a gas-injection string as shown; or a plunger-lift installation may be installed. By appropriately designing the concentric tubing extensions below the dual string packer, the production system for each zone can be reversed with the lower zone discharging into the annulus.

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Tenamene
EASTMAN GASOLINE ADDITIVES

by J. F. Wilson

Low-Temperature Fractional Analysis—3

THE background for the N.G.A.A. Low-Temperature Fractional-Analysis School was explained in the first two installments of this series (*The Oil and Gas Journal, March 29, 1954, page 125, and April 12, 1954, page 165*). It was noted that one of the common errors was the calculation of compressibility factors. This should be calculated as a function of the temperature, composition, and total pressure of the gas in the receiver.

The basic equation used for calculating the number of standard cubic centimeters of a component in the receiver is:

$$\text{Gas volume (60° F. and 760 mm.)} = V_r \frac{288.72}{T_r}\left(\frac{P_2}{Z_2}-\frac{P_1}{Z_1}\right)\frac{1}{760} \quad (1)$$

Z_1 = compressibility factor of gas in receiver at initial receiver pressure and composition
Z_2 = compressibility factor in receiver at final receiver pressure and composition
P_1 = initial absolute total pressure in receiver
P_2 = final total pressure in receiver
V_r = receiver volume
T_r = receiver temperature
288.72 = 60° F. converted to °K.

The compressibility factors for the start and finish of each component are calculated according to Equation 2:

$$Z_m = X_A Z_A + X_B Z_B + X_C Z_C + \ldots . \quad (2)$$

Z_m = compressibility factor of gas mixture in receiver at a given condition of temperature, total pressure and composition
X = mole fraction of components A, B, C, ...
Z = compressibility factor of components A, B, C, . . . at this temperature and total pressure

Fig. 1 shows a schematic drawing of the cooling section of the column as supplied by the manufacturer. Liquid nitrogen is forced by air pressure from a dewar flask into the metal nitrogen vaporizer where its latent heat is absorbed. The resulting gaseous nitrogen is led through four small holes against the distilling tube and out through the vent at the top of the column. The position of these holes against the distilling tube and above the thermocouple results in a cold spot for the condensation of liquid.

In the earlier classes at the school liquid holdup was observed in this section of the column. Of the several modifications tried to eliminate liquid holdup, the most successful was the replacing of the metal vaporizer with the arrangement shown in Fig. 2. A cork terminating about ¼-in. above the thermocouple junction fits around the distilling tube. A tube extends through the cork and a wad of glass wool is placed at the point where the vacuum jacket narrows down to a close fit around the distilling tube. When the analysis is proceeding on a sample containing no components more volatile than ethane, the cooling is effected entirely by vapor; that is, dry air or nitrogen passes through the dewar flask of liquid nitrogen. The resulting cold dry gas goes through the hole in the cork into the condenser section, through the plug of glass wool, down around the distilling tube, and finally out through the side outlet on the column. Thus, some cooling is effected over the entire length of the distilling section and the cold vapor is led down the column to eliminate any possibility of cooling above the thermocouple junction. If the sample being analyzed contains components more volatile than ethane, the sensible heat of the cold gas is insufficient for their condensation. Hence, liquid nitrogen is introduced through the tube in the cork and vaporized on the plug of glass wool. Again the vapors from the nitrogen pass down around the column and out the side outlet, rather than out the top of the column. This cooling method effectively eliminated liquid holdup.

At the same time these changes were made in the arrangement of the apparatus for cooling the top of the column, changes were made in the electronic control circuit for the automatic cooling so that part of the column cooling was on continuously and a part came on as required to maintain the column pressure at the desired value.

Author is research engineer, Union Oil Co. of California. Paper presented at C.N.G.A. meeting.

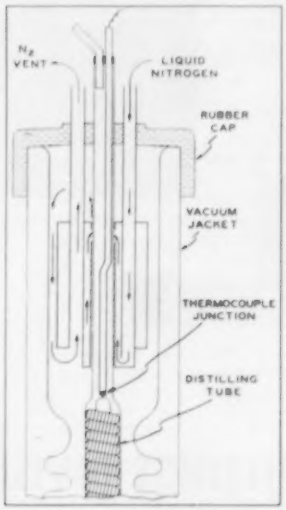

Fig. 1—Reflux cooling in Podbielniak "Hyd-Robot."

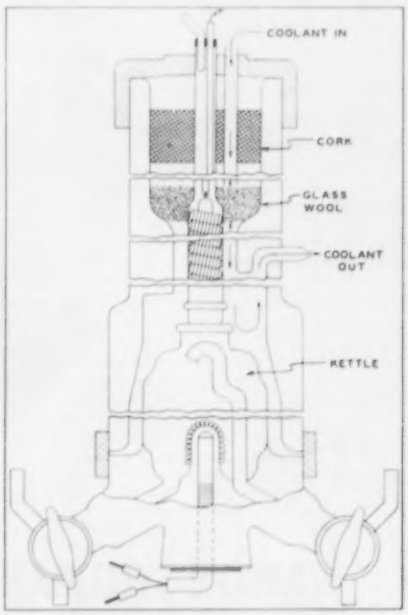

Fig. 2—N.G.A.A. School reflux cooling method.

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Selection of Filled-System Thermometers—1

by F. A. Faust

TEMPERATURE is measured usually in an indirect manner. We observe and measure physical or electrical changes which temperature changes produce and then state these physical or electrical changes in terms of temperature.

The expansion or varying pressure of fluids was historically the first physical phenomenon to be used for measuring temperatures—probably because pressure is easy to measure. The filled-thermal or "pressure-actuated" system is today used in most recording and controlling thermometers for temperature measurement up to 1,200° F.

All matter undergoes physical reaction to heat changes. Temperature is a measure of the molecular movements of matter due to its content of heat energy. Adding heat energy to matter increases the velocity of its molecules. The matter expands or contracts in volume, its electrical resistivity changes, fluids exert varying pressures, the viscosity of fluids changes, etc. Temperatures can be measured by evaluating any of these physical reactions caused by changes in heat energy. Of these, the easiest physical reactions to measure are the expansion or pressure variation of fluids. The varying volumes and pressures of fluids with temperature are the physical phenomena used in filled-system thermometers.

Filled Systems

A filled-system thermometer may be defined as a device which reacts to the effect of temperature on a medium which is completely enclosed or contained. Such a system consists of a sensitive bulb, a length of capillary tubing, and a pressure-measuring element, usually some form of bourdon tube. The type of filling medium used and the manner of using its volumetric and pressure changes are the bases for classifying filled-system thermometers.

Filled-system thermometers are generally classified according to type of filling fluid used and the principle of operation. Although no official classification has ever been established, four thermometer classifications are generally accepted by instrument makers and users.

Class I includes liquid-filled systems that use the thermal expansion of the liquid as a measure of temperature at the bulb.

Class II includes systems partially filled with liquid that use the vapor-pressure in the unfilled portion of the system as a measure of the temperature at the bulb.

Class III includes gas-filled systems that use the thermal expansion of the gas as a measure of the temperature at the bulb.

Class V includes mercury-filled or mercury thallium eutectic amalgam operating on the principle of liquid expansion.

Note: The designation Class IV has been purposely omitted to avoid confusion with former classifications of various manufacturers.

Parts of Filled-System Thermometers

The basic parts of all filled-system thermometers are alike in general design. Therefore, the general function, requirements, and construction of the parts of all such thermometers can be studied together. However, there are important differences between the four classes of filled-system thermometers as to both construction and operating principle. A typical filled-system thermometer consists of the following basic parts:

1. Thermal system. (a) Bulb (sensing element). (b) Capillary tubing. (c) Filling fluid. (d) Measuring element.

2. Secondary mechanisms. (a) Linkage. (b) Indicating pointer, recording pen, alarms, controlling or telemetering devices.

Basic design factors . . . The whole thermal system must be designed so that it measures temperatures **at the bulb only.** It must respond as little as possible to all other temperatures. These other temperatures that exist along the tubing and around the measuring element are called "ambient temperatures." If the thermal system responds to such tubing or element ambient temperatures, it will incorrectly measure the true bulb temperatures. Such errors are called "ambient temperature errors."

In liquid and gas-filled systems, while errors due to tubing and element ambient temperatures can be minimized, they can not be eliminated, without adding compensating devices. Ambient errors are minimized by having the largest possible part of the system volume in the bulb and as little volume as possible in the tubing and measuring element. The object is to have the measured temperature at the bulb exert the dominating effect on the internal pressure and to have the ambient temperatures exert the least effect. For example: in a typical Class III gas-filled system, the bulb volume will be from 30 to 50 times larger than that of the tubing and element combined.

The bulb . . . The bulb is that part of the thermal system which is exposed to the temperature to be measured. It is, therefore, the "sensing element" of filled-system thermometers. The bulb consists of three basic parts: the sensitive portion, the extension, and the connector.

The basic requirements of a filled-system thermometer bulb and the design factors involved are:

1. High speed of response. (a) Large area to volume ratio. (b) Minimum wall thickness. (c) Metal of high heat conductivity. (d) Metal of low specific heat.
2. Low thermal error. (a) Low radiation. (b) Low heat conduction through extension and mounting.
3. Small volume change. (a) Metal of low expansion coefficient.
4. Mechanical strength. (a) For internal filling fluid pressures. (b) For external pressure and stress.
5. Corrosion resistance to both the filling fluid and the measured medium.
6. Ease of manufacture and low cost.
7. Physical size and shape convenient for insertion into industrial equipment.

The sensitive portion of the bulb must be designed to follow temperature changes of the measured medium as quickly as possible. This means that heat must be transferred between the measured medium and the filling fluid in the sensitive portion as rapidly as possible. To obtain such fast response to temperature changes, the ratio of surface area to volume in the sensitive portion should be as high as possible. For tubing will have a very large ratio of surface area to volume. This area to volume ratio consideration dictates the long, tubular shape of standard bulbs; the length of bulbs is usually several times their diameter.

The metal of which the sensitive portion is made must be highly conductive to heat, in order that heat can be transferred rapidly through the bulb walls. The bulb itself should have low heat capacity so that little heat flow will be required to change its temperature. This calls for a bulb metal of low specific heat.

For accurate metering, the sensitive portion of the bulb must attain as nearly as possible the true temperature of the measured medium. This requires that the sensitive portion of the bulb neither lose nor gain heat to or from any other medium than the measured medium. Good bulb design will minimize heat loss or gain by radiation or by conduction which occurs through the bulb extension and mounting.

In scale characteristics only Class II is nonlinear. This may be either desirable or undesirable, depending on whether the major interest lies in the upper portion of the range or whether readings are equally important all through the range.

Author is manager educational department, Bristol Co., Waterbury, Conn. Paper presented at University of Florida symposium on industrial instrumentation, 1954.

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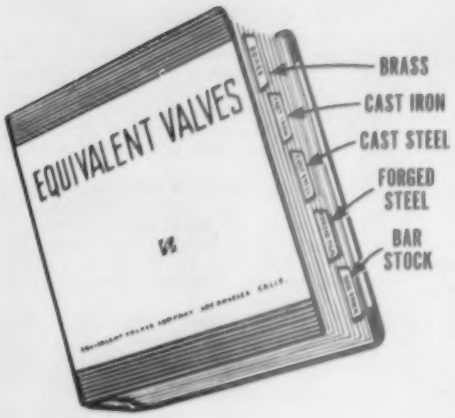

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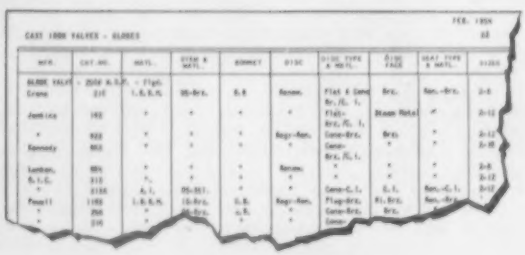

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BARTLESVILLE, OKLAHOMA

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

Relationship Between Cetane Number and Other Physical Properties

"Cetane number is troublesome because most small refiners do not have A.S.T.M. diesel-engine attachments. What is the best of the many methods of estimation that are available?"—C.P.M.

According to H. D. Young, leader of the Ignition Quality Investigation Group CFR Diesel Fuels Division, the most accurate estimation method is the so-called calculated cetane number, which is:

Calc. C.N. = 175.4 (log midboiling point, °F.) + 1.98 (A.P.I. gravity) — 496.

This conclusion is based upon an extensive collaborative study of 638 fuels, and the study is described in "Method for Estimating Cetane Number," Third World Petroleum Congress (1951), Section VI Proceedings, p. 420.

Although the calculated cetane number is the most accurate estimating method, it must be pointed out that a great variation among the data was evident. Thus, although the average deviation of various kinds of stocks was only 2.3 to 5.2 cetane number units, extreme samples showed deviations of even plus or minus 17 units. It is clearly evident that cetane number (like octane number) is an exceedingly complex property, one that cannot be accurately computed from general physical data.

Somewhat less accuracy was found in correlating diesel index and characterization factor with A.S.T.M. cetane number as indicated in Table 1. The equations for relating cetane number and diesel index or characterization factor are:

Cetane No. = 12.9 + 0.66 (D.I.)

Cetane No. = 28.12 (C.F.) — 280.2

In view of the great variation evident in all of the correlation methods, they are somewhat equal. Thus, if midboiling-point data are not available (for the calculated cetane number) then aniline point and diesel index may be used. Likewise characterization factor or "base" of the oil may be generally known, although specific information may be totally lacking as to gravity, boiling range, or aniline point. The relationship between characterization factor, diesel index, and cetane number is indicated in Table 2.

Young presents a nomographic chart by which the calculated cetane number can be obtained from A.P.I. gravity and midboiling point (A.S.T.M. 50 per cent recovered), but of course, the equation on this page can be used.

TABLE 2
Relationship of Cetane Number to Physical Properties

C. F. of fuel	A.S.T.M. Cet. No.	Diesel index
10.6	18	...
10.7	21	12.3
10.8	24	16.8
10.9	26.5	20.6
11.0	29.5	25.2
11.1	32	29.2
11.2	35	33.5
11.3	38	38.0
11.4	41	42.5
11.5	43.5	46.4
11.6	46	50.2
11.7	49	54.6
11.8	52	59.2
11.9	55	63.8
12.0	58	68.3
12.1	60.5	72.1
12.2	63	76.0
12.3	66	80.5
12.4	69	...
12.5	72	...
12.6	74.5	...

TABLE 1—ACCURACY OF CETANE NUMBER RELATIONSHIPS

Type of fuel—	No. of samples	Standard deviations (units of cetane number) Calculated Cetane No.	Diesel index	Characterization factor
Straightrun	137	3.1	5.0	4.1
Straightrun*	187	3.0	4.5	3.3
Commercial	73	2.3	4.0	3.1
Coded	87	4.7	5.0	4.6
Thermally cracked	22	5.2	7.2	5.9
Catalytically cracked	56	3.5	4.3	4.5
S.R. and cracked blends	10	3.4	5.4	6.0
S.R. and catalytic blends	41	2.9	5.2	3.8

*Not identified as such.

Although the calculated cetane number relationship indicates that cetane number is always increased by an increase in midboiling point, there is substantial evidence that this is not the situation when diesel fuels of different boiling range but all produced from the same crude oil are examined. Diesel index comes to a maximum at some midboiling point close to 550° F., but the exact behavior of cetane number is not clear (this page "Effect of Boiling Point on Diesel Index," September 15, 1952). It would also be interesting to know if the kind or base of crude oil has any effect on the relationships shown herein.

Ethylene Yields

"What yield of ethylene is produced when cracking propane and when cracking gas oils?"—R.V.A.

Strangely enough, about the same number of pounds of ethylene is produced when cracking the same volume of any of the common charge stocks. Thus, the ultimate yields (by recycling of unwanted products) are about:

	Pounds per bbl.	Wt. of ethylene*	Pounds C_2H_4
Ethane	131.0	75	98
Propane	178.1	53	94.4
Butanes	204.0	47	95.9
Gas oil (34° A.P.I.)	299.0	32	95.6

*Nearly the very maximums stated in the literature.

Smaller yields are sometimes stated in the literature but these are mainly for less complete operations. In the extreme, the yields by once-through operations may be about:

	Ethylene (% by wt.)
Ethane	75
Propane	15-25
Butane	10-15
Gas oil	8-17

The great variation in once-through yields is due primarily to the use of various conversions per pass, and hence the once-through yields are not of much significance with respect to ultimate or final yields.

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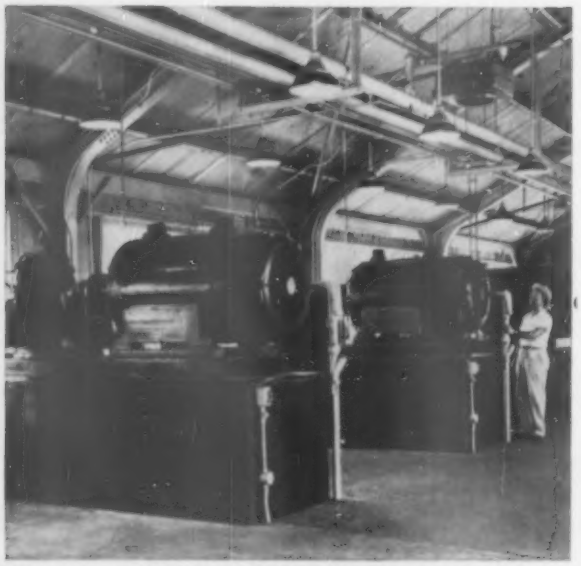

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RYERSON

by L. L. Davis and
H. E. Luntz

REFINER'S NOTEBOOK

How to Determine Diluent in Used Railway Diesel Lube Oils—4

THE use of a Viscosity Blending Scale (VBS) was outlined in installment No. 3. Fig. 4 provides ready means for determining VBS from viscosity for roots 4 and 5.

Copies of charts, 8½ by 11 in., represented by Fig. 7, (to be presented in the next installment of this series) and strip scale charts of VBS (covering the information in Fig. 4), in sufficient detail to permit easy reading for solution of problems of this type may be obtained from Librarian, Development and Research Department, Continental Oil Co., Ponca City, Okla. In these VBS charts (available from Continental) the scales inside the strips are VBS numbers, and the scales along the edges of the strips are the viscosities. (In writing to Continental Oil Co. for these charts, reader should ask for original figure Nos. 7, 10, and 11.)

The procedure for calculating the viscosity of a blend of oil with 8 per cent diluent is given in Table 4. The oil had a viscosity index of 90+; and therefore VBS-5 was applicable.

The viscosity blending numbers for the oil and diluents given in lines 2 and 4 were obtained from the VBS-5 chart. In lines 5 and 6, the relative portion of the viscosity blending numbers are calculated (8 per cent for diluent and 92 per cent for oil). The sum in line 7 gives the VBS of the blend, and from the VBS-5 chart the viscosity of the blend is obtained as shown in line 8. The differences in viscosity between the original oil, line 1, and the blend, line 8, gives the decrease in viscosity caused by 8 per cent of the respective diluents. In similar manner, the decrease in viscosity may be calculated for a series of blends of from 1 per cent to 30 per cent diluent and smooth curves drawn as shown in Fig. 5.

TABLE 4—PROCEDURE FOR CALCULATING BLEND VISCOSITY

Line	Diluent: Kerosine	Diesel fuel	Hvy. diluent
1. Viscosity of oil, cs. at 100° F.	166.8	166.8	166.8
2. VBS-5 of oil	3,917	3,917	3,917
3. Viscosity of diluent, cs.	1.452	2.864	5.971
4. VBS-5 of diluent	439	1,160	1,837
5. 0.92 × VBS oil	3,604	3,604	3,604
6. 0.08 × VBS diluent	35	93	147
7. VBS of blend	3,639	3,697	3,751
8. Viscosity of blend, cs.	92.2	104	116.2
9. Decrease in viscosity, cs.	74.6	62.8	50.6

Correlation of Flash

The authors have failed to find literature references to a general flash blending correlation. Based on the 82 diluent blends made in this study, a tentative empirical correlation has been developed from which the flash of diluent-lube oil blends may be estimated.

This correlation and its application are given below, being explained by means of an example. In the following description,

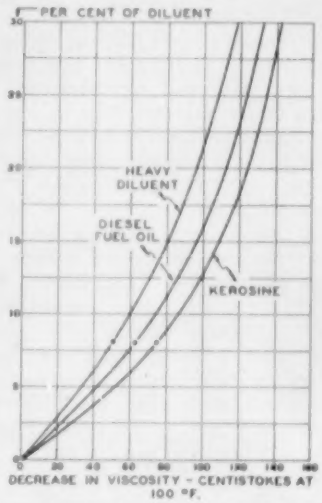

Fig. 5—Calculated decrease in viscosity by dilution (original diesel oil viscosity, 167 cs.).

Fig 7 (presented in the next installment) is a general correlation, and the other figures apply directly only to the specific example at hand. Similar charts could be drawn for any other specified condition.

The basis of the correlation is shown in Fig. 6. The vertical scale represents the Pensky-Martens flash of the oil. The left-hand index (0 per cent reduction in flash) represents the flash of the new oil, and the right-hand index (100 per cent) represents the flash of the diluent. For purposes of discussion, assume an oil B having a flash of 435° F. and diluents C, D, and E with flash points of 315°, 192°, and 140° F., respectively. Straight lines drawn between the flash of the oil and the flashes of the diluents (lines AC, AD, and AE) represent the flashes of all possible blends of the oil and the respective diluents. If the measured flashes of experimental blends are plotted on these lines, it will be found that the points of equal volume per cent diluent lie on straight lines converging at the focus "F" as shown by the 5 per cent and 20 per cent diluent concentration lines on the chart. The equal percentage dilution lines for any given oil may be defined by the location of the focal point and their intercept on the flash line of the oil, that is, line AB at 435°. The horizontal scale is a convenient method of recording the intercepts on the oil flash line. In the example, the 5 per cent and 20 per cent lines intercept the oil flash line at scale readings of 29 and 56.7, respectively.

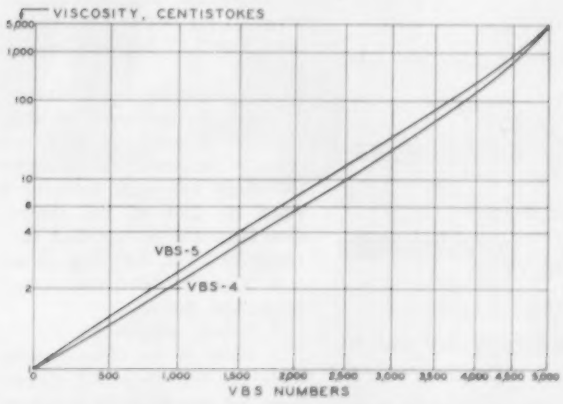

Fig. 4—Viscosity blending scale. Strip charts covering information in Fig. 4 in greater detail are available from Continental Oil Co.

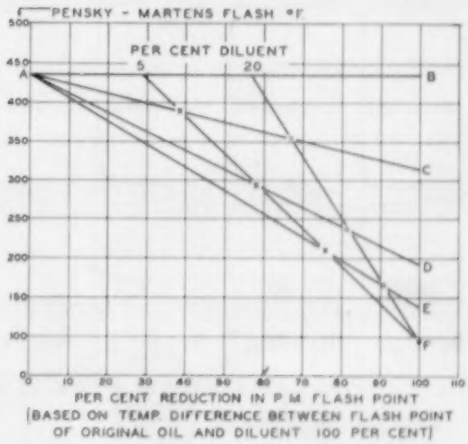

Fig. 6—Basic correlation of flash and per cent diluent.

Measurement of Spontaneous Potential

by R. L. Martin

ALONG each current flow line the intensity of the current is constant. The drop in potential varies according to the resistance of the section through which it flows. This means that the total drop in potential is divided between the different formations and the mud according to the resistances encountered in each. Consequently, the drop in potential in the mud is only part of the total e.m.f. unless the resistance of the mud is very large compared with the others.

The S.P. log records the drop in potential occuring in the mud. A single electrode in the hole suffices to do this. In practice electrode M, in the hole, measures this potential with respect to a grounded electrode N. It follows that the amplitude of the peak on an S.P. log approaches the amplitude of the static S.P. only in favorable cases. When the resistance of the mud to the flow of the S.P. current is not large compared with the resistance in the formations, then the S.P. log will show a peak of lesser amplitude than the static S.P. diagram.

Author is assistant professor of petroleum engineering, Missouri School of Mines and Metallurgy.

The current circulates in the mud some distance above and below the boundaries of the formation. As a result, although the static S.P. diagram indicates sharp breaks corresponding to the boundaries of the bed, the S.P. log shows progressive changes in potential extending beyond the boundaries of the bed. This may be seen clearly on the upper right hand curve of Fig. 1.

The slope of the S.P. log measures the potential drop per unit length in the hole, which is proportional to the intensity of the S.P. current at the corresponding level. Starting from above the sand, the slope increases progressively because the current density increases also, until the sand/clay contact is reached. At this level the current intensity is at a maximum. Consequently the S.P. curve has a maximum slope, or an inflection point.

Below this point the current density decreases progressively until it becomes nil in the middle of the sand. This corresponds to a point of maximum deflection. Farther down the current flows in the opposite direction so that the slope of the S.P. curve is reversed. The slope increases progressively until a new maximum is reached opposite the lower sand/clay contact. Below this second inflection point the slope decreases as the current density decreases.

The correspondence of these inflection points to formation contacts should be emphasized, because this is the basis of estimating bed thickness from S.P. curves. If the boundary occurred at the mid-point of the deflection errors could result in some cases, as may be seen in Fig. 1.

The shape and amplitude of the S.P. curve opposite a given bed may be influenced by:

1. Total e.m.f. involved (static S.P.)
2. Thickness of the bed, e.
3. Resistivity of the bed, Rt.
4. Resistivity of the surrounding shale, Rs.
5. Resistivity of the mud, Rm.
6. Diameter of the bore hole, d.
7. Depth of invasion of the mud filtrate, Di.
8. Presence of impervious and conductive material such as silt and clay, inside the permeable bed.

Quantities (2) through (7) are those which affect resistivity measurements also. In the first part of the discussion of S.P. curves only the effects of factors (1) through (6) will be considered.

The effect of bed thickness is best explained by reference to Fig. 1. On the right-hand side a geologic section is shown, with the bed thickness related to the hole diameter. To the extreme left are shown static S.P. diagrams and the resulting log when Rt (of both sand and shale)= Rm. The S.P. log has been calculated.

The remaining illustrations in Fig. 1 show the influence of mud resistivity. In order to allow calculations to be made, the resistivity of the sands has been assumed to be equal to that of the shales, but now both are greater than the mud resistivity. The S.P. log shows:

1. More rounded curves opposite formation contacts.
2. Lower amplitudes.
3. Most of the characteristic features can be recognized except perhaps for the shale of thickness d/2 when Rt/Rm = 101.

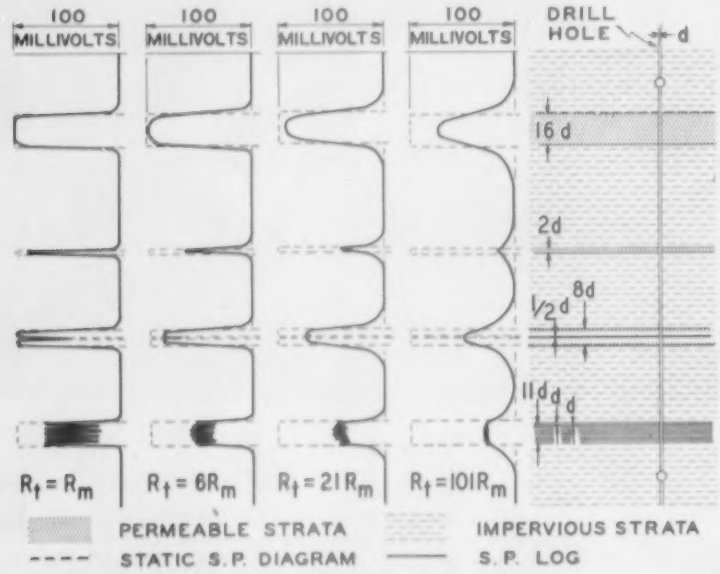

Fig. 1—Comparison of self-potential logs. From Doll, H. G., "The S.P. Log: Theoretical Analysis and Principles of Interpretation," A.I.M.E. T.P. 2463, 1948.

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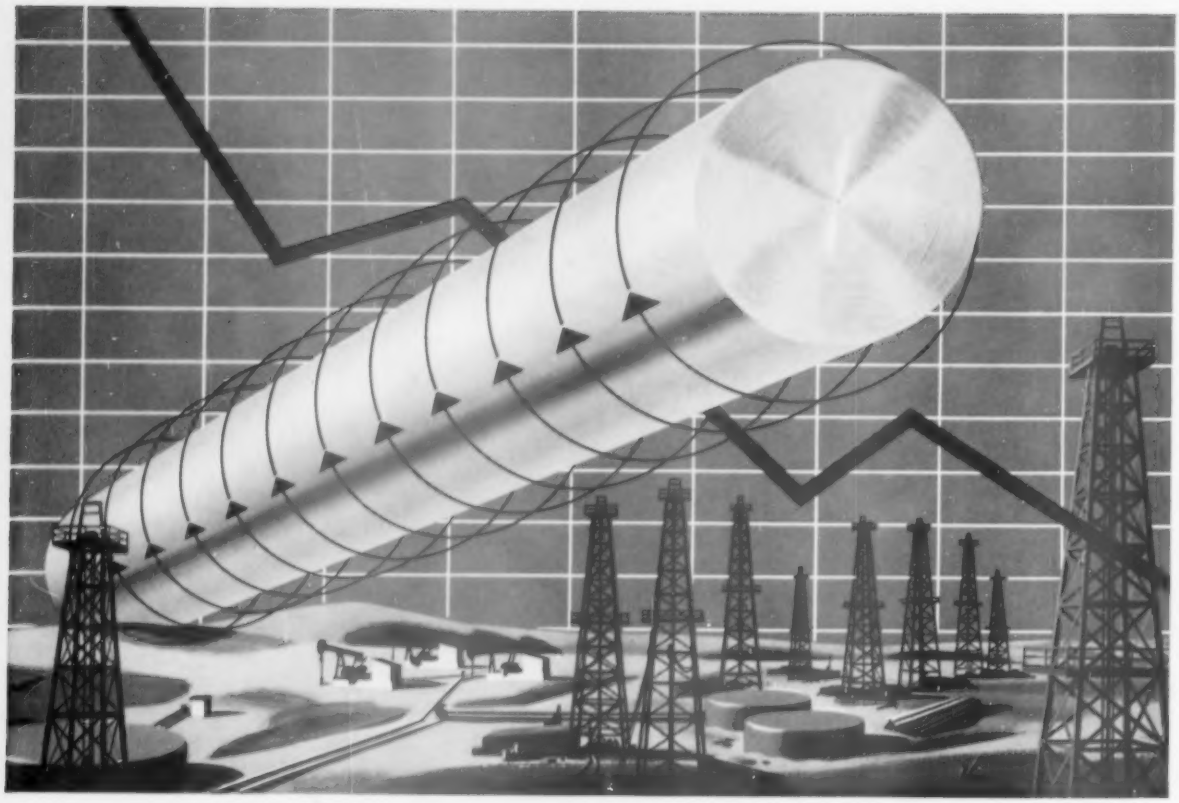

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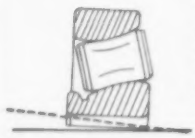

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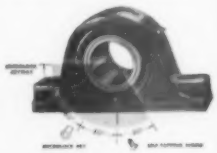

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Among the Drilling Contractors

New Contracting Firm To Drill in California

R. M. (Rusty) Walters, F. L. Shepherd, and Paul E. Gregg, all long associated with drilling operations in California, have formed a new partnership to engage in contract drilling on the Pacific Coast. They will operate as Rusty Walters Drilling Co., with headquarters at Bakersfield, where their central warehouse and yards are located.

The company is starting with a newly assembled, mobile drilling rig capable of drilling to 6,000-ft. depths with 4-in. drill pipe. First job will be for Vanray Oil Co. in the Round Mountain area, Kern County.

Walters has been in oil-field work since 1920, starting with General Petroleum Corp. In recent years, he has served as tool pusher for various contractors.

Shepherd's debut to the oil business was in 1919, when he went to work for Standard Oil Co. of California at Taft field. He was in the Standard crew which brought in the discovery well at Wheeler Ridge in the early '20's. He has engaged in contract drilling work since 1927, and was a partner in Shepherd-Robertson, Inc., Bakersfield contracting firm, for 6 years.

Gregg has had long experience as a driller, and drilling foreman for many years.

Atlas Drilling Co. will be the contractor on another well Atlantic Refining Co. will drill in its Baton Rouge field, 2 miles south of Baton Rouge, in East Baton Rouge Parish, South Louisiana. The projected well, 1 DeFour, in 53-7s-1e, will be the fourth for the field, opened a year ago. Hole will be carried to 10,500 ft.

Delta Gulf Drilling Co., Tyler, Tex., has taken a 7,500-ft. contract with San Juan Exploration Co., of Dallas, for a wildcat test to be drilled in Iberia Parish, Louisiana Gulf Coast. Location is for 1 Patout-Olivier, in 8-13s-7e, 3½ miles south of Iberia.

Kirkwood & Co., Alice, Tex., is drilling for Rowan & Hope at a wildcat location, 1 Impson, 10 miles southwest of Beeville, in Bee County, South Texas. It is a 5,000-ft. test, in I&GN Survey. Location is northwest of Sliva field, nearest production.

Thomas P. Pike Drilling Co., Los Angeles, has two new contracts by The Texas Co. One is for a directional well to be drilled under the Long Beach airport. It will be the operator's second test under the airport. Hole is projected to a total depth of 9,000 ft.

SHUTDOWN FOR PICTURES.—Rig floor on a deep test Chance Drilling Co., Inc., Houston, is drilling for Panuco Oil Leases, Inc., and Ivy Minerals Corp. near Webster, southeast of Houston, in Harris County, Texas Gulf Coast, showing: (Top row, left to right) A. L. Teel, crewman; P. E. Smith, tool pusher; W. T. McCormick and W. L. Griffin, crewmen; Jack Aldred, drilling superintendent; Tony Volotko, Mission Manufacturing Co.; and (kneeling, same order) M. W. Hendrickson and R. J. Collins, crewmen. (Photograph by courtesy of Mission Manufacturing Co., Houston.)

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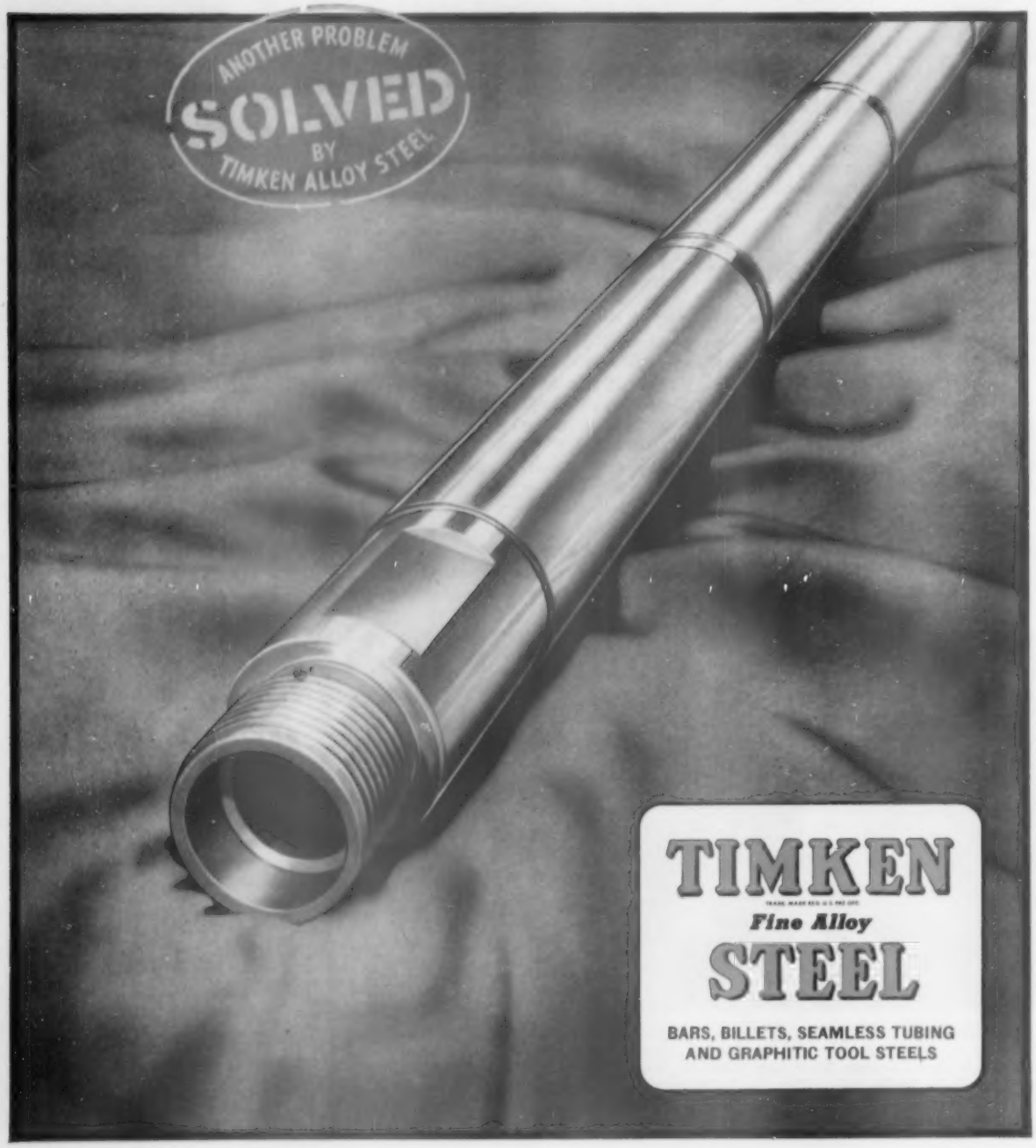

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The other contract is for an 8,500-ft. extension well in the recently discovered Olive field, in Orange County, California.

Falcon Seaboard Drilling Co., Tulsa and Houston, has a new well under way for Amerada Petroleum Corp. in the latter's recently opened Leleaux gas field, 12 miles northwest of Abbeville, in northern Vermilion Parish, coastal Louisiana. Location is for 1 Armogem Adam. Contract is for 11,000 ft.

E. J. Pearl is contractor on a projected 4,150-ft. wildcat test Robert H. Blair and John B. Vreeland, of Corpus Christi, are starting at 1 J. M. Bennett, Jr., in the E. H. Caldwell Survey, 7 miles northwest of Realitos, in Duval County, Southwest Texas. Location is 4 miles from nearest production.

Miller & York, Bakersfield, Calif., will drill the new wildcat test which Standard Oil Co. of California is undertaking in the Black Canyon area, in San Benito County, northern California. Location, listed as 27 Eade, in 35-18s-9e, is 10 miles north of King City. It is 6 miles south of production in the Bitterwater area.

Coastal Drilling Co., Los Angeles, has contracted with Sunray Oil Corp. for a 12,000-ft. wildcat test to be drilled southeast of Greeley field, near Bakersfield, in Kern County, California. The test will be carried as 21-30 KCL with Western Gulf Oil Co. as a joint operator.

Trans-Texas Drilling Co., San Antonio, is under contract to Geochemical Surveys and Lone Star Producing Co., Dallas, for a 9,500-ft. test to be drilled at a wildcat location, 1 Lyons, in V. Zepeda Survey, 1½ miles northeast of Runge, in Karnes County, South Texas.

Cotton Dickson has a new drilling-barge job under way in San Antonio Bay, Calhoun County, Texas Gulf Coast. The test, a wildcat in State Tract 107, is being drilled under contract for Arkansas Fuel Oil Corp. Location is 4 miles offshore, southwest from Seadrift. Hole is projected to 10,000 ft.

Stephens Production Co., Little Rock, will handle contract for Murphy Corp. 1 Barton, C NE SW 10-8n-19w, 5,500-ft. wildcat 1 mile south of Moreland in Pope County, central Arkansas. This is Murphy's first C test on acreage assembled in Arkansas River Valley during 1951. Proposed depth is believed sufficient to test the Hale sand zone.

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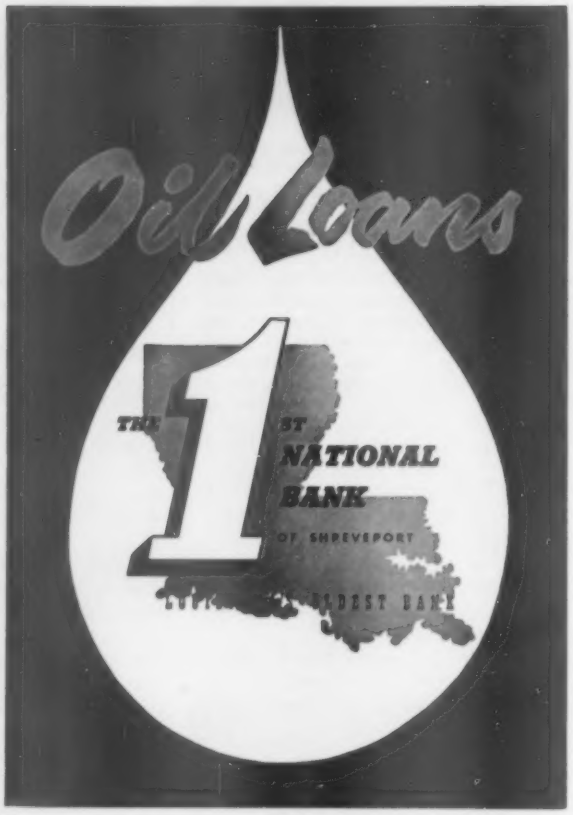

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REFINING

Canada Demand Up

Consumption increasing says B.A. vice president

CONTINUED building will be required to keep pace with Canadian demand for petroleum products, D. L. Campbell, vice president for manufacturing, British American Oil Co., Ltd., said at the company's recent annual meeting in Toronto.

The company last year processed a record 31½ million barrels of crude in the five refineries. This represented 95 per cent of rated capacity, a high average for which improved maintenance and good employe morale were credited.

The company will shortly contract to expand the crude capacity of the Clarkson refinery, where the existing topping units have been successively expanded by bottleneck removals from the original 8,250 to 20,000 bbl. per day. The new crude unit may double the basic crude capacity, as the new fluid catalytic cracking unit which goes on stream this summer, is sized for double the current crude throughput.

British American will shortly contract for the building of two catalytic reforming units, said Campbell. They will be located at the Calgary and Montreal refineries and will employ platinum catalyst. Additional reformers will be needed within the next 5 years at the company's other plants, he added.

Last year the company completed a new grease plant at Clarkson, and began producing a new crankcase lubricating oil for diesel locomotive use. Production also began on the only automatic transmission fluid made in Canada.

Gulf's Fort Worth Refinery Shut Down

FORT WORTH.—Gulf Oil Corp's. 8,000-bbl. refinery here was shut down on schedule May 1.

The 42-year-old refinery, which was placed in operation in the Oakhurst area of Fort Worth in 1912, was closed down by Gulf because it had been losing money for several years.

Gulf listed three reasons why the operation became unprofitable. The company reasoned that to manufacture the quality of gasoline which it deems will be required during the next few years would demand that extensive and costly equipment be installed at Fort Worth which would duplicate that already available at Gulf's other plants in Texas.

Secondly, the plant site was thought to be too small to be suitable for the large equipment necessary to permit profitable operation. Thirdly, the company held that it is uneconomical to build and operate refining facilities of small capacity to supply products for a limited territory.

Western Refiners Set Meeting for Wichita

WICHITA.—The Western Petroleum Refiners Association will hold a regional technical-industrial relations meeting here May 27-28.

The first day of the 2-day meeting will be devoted to industrial relations. C. R. McPherson, advertising manager for Vickers Petroleum Co., will serve as chairman on a discussion of the "right to work" law which has been adopted in several midwestern states recently.

The technical session will be held on May 28 with papers on blending stocks, refinery instrumentation, and refinery maintenance being presented. The feature of the technical session will be a paper presented by Arthur C. Sweeney, Jr., Arthur C. Sweeney Co., on use of the X-ray isotope and X-ray defraction applications to refinery problems.

Ashland Will Construct 6,000-Bbl. Houdriformer

ASHLAND, Ky. — Ashland Oil & Refining Co. has completed licensing arrangements with Houdry Process Corp. of Philadelphia for the construction of a 6,000 bbl. per day Houdriforming unit to be built at the company's Catlettsburg, Ky., refinery.

The unit, complete with guard case, prefractionation and stabilization facilities will process naphthas from Illinois, Louisiana and Kentucky crudes, to produce high octane gasoline blending stock and high grade solvents.

Refinery on Stream

DICKINSON, N. D. — The 2,000 bbl. per day refinery of Queen City Oil & Refining Co. has gone on stream, making it the first active refinery in

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Crown Central Petroleum Corporation is installing a new

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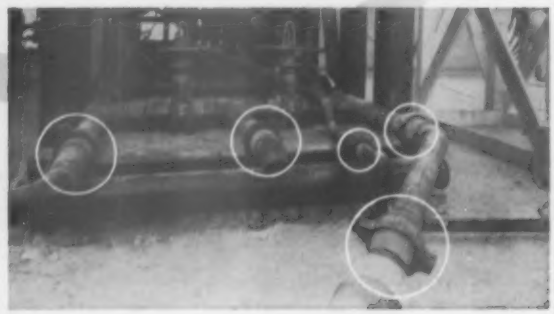

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These photos show some of the WECO Fig. 602 Unions used exclusively on a 10,000-ft. rig recently shipped to a foreign country.

PESA

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the North Dakota section of the Williston basin.

The refinery will process oil taken from the Fryburg pool of Billings County in southwestern North Dakota.

Petrochemicals

Standard (Calif.) Plans Big Isophthalic Plant

RICHMOND, Calif.—Standard Oil Co. of California plans to build a multimillion dollar plant here for the first commercial production of isophthalic.

Isophthalic, which has been made only in experimental quantities so far, will be used to make protective enamels for cars and household furnishings. It will also serve as a binder in glass fishing rods, molded auto bodies and lightweight glass fibre boats.

The plant will use metaxylene produced from the company's catalytic reforming operations at its refinery here to make the isophthalic.

Plant Site Selected

PORT ARTHUR. — Koppers Co., Inc., has selected a Port Arthur site for its new petrochemical plant which will produce polyethylene plastics.

Koppers went on stream in early 1953 with a plant at Port Arthur which produces ethyl benzene, an intermediate in the production of styrene, which the company uses in making polystyrene plastics and synthetic rubber.

Construction on the new plant is expected to begin within several months with first production scheduled for mid-1955. The plant will purchase its ethylene gas from Gulf Oil Corp. which is building new facilities at its Port Arthur refinery.

Petrochemical Plant Planned at St. Louis

ST. LOUIS.—Mississippi River Fuel Corp. has announced plans to build a $15,000,000 ammonia plant to produce 200 tons per day of anhydrous ammonia, nitric acid and ammonium nitrate from natural gas.

The company announced the purchase of land on the Mississippi River near here for the plant sometime ago, *(The Oil and Gas Journal, April 12, page 185)*. Since purchasing the land, the company has conducted an economic study which proved the feasibility of locating an ammonia plant in the St. Louis area where favorable rail, water and truck transportation facilities are available.

Pipeline Patrol

. . . Report on Construction

Progress on Oklahoma-Mississippi line

AN important outlet for products from Oklahoma refineries will be available in June upon completion of a 170-mile, 10 and 12-in. line by Oklahoma Mississippi Products Line, Inc. This line, the first products line to extend directly eastward from Oklahoma, will deliver a maximum of 35,000 bbl. per day of gasoline and distillate from plants near Duncan and Allen, Okla., to a terminal on the Mississippi near West Memphis, Ark.

Cleaning and priming operations, pictured above on the River Construction Corp. spread, were preliminary to coating with coal-tar enamel and wrapping with glass and felt.

Under Way, Contracted, and Planned . . .

PIPELINE activity as reported below by The Oil and Gas Journal is compiled from information received from pipeline companies and contracting firms.

These projects include those planned, proposed, under way, and contracted. Uncontracted projects are indicated by a • preceding the job.

Crude-Oil Pipelines

• **Atlantic Pipe Line Co.**—Planning 40-mile, 8-in., looping of present crude line from Andrews to Midland, Tex.

• **California - Oregon Pipe Line System**—103 miles 6-in., proposed, Crescent City, Calif., to Medford, Ore.

• **Cities Service Pipe Line Co.**—60 miles, 12-in., Sour Lake, Tex., to Houston, Tex. O. R. Burden Const. Co. Completion set for June 1954.

• **Magnolia Pipe Line Co.**—208-mile, 20-in. crude line planned from Corsicana to Magnolia's refinery at Beaumont, Tex. Work expected to start during second quarter of 1954 with completion set for 6 months. The line will cross the Trinity River 10 miles south of Oakwood and will pass near Crockett, Livingston, and Sour Lake. H. B. Zachry, Cont.

• **NNCW Pipeline Co.**—127-mile line, proposed, from Weston County, Wyoming to Casper. 108 miles of 10-in. and 19 miles of 8-in. Est. Cost: $3,500,000.

• **Orchard Pipe Line Co.**—45-miles, 8-in., proposed to transport crude from Masters field in Logan County, Colorado, to point 4 miles northwest of Orchard. Estimated cost: $811,250.

• **Pawnee Pipe Line Co.**—35 miles of 10, 8, and 6-in. line approved from Adena field in Colorado to Merino, Colo.

• **Progress Pacific Pipeline Co.**—1,100 miles, 24-in., planned, Odessa, Tex., to Los Angeles, Harbor, Calif.

• **Roosevelt Oil & Refining Corp.**—22 miles, 4 and 6-in., planned St. Helen to Norwich, Mich.

• **Sinclair Pipe Line Co.**—20 miles, 12-16-in., planned, Monee to Blue Island, Ill. Completion date 4-54.

• **Sioux Pipe Line System.**—Under study by Shell Pipe Line Corp. for group of 12 Williston basin producers. Length of line,

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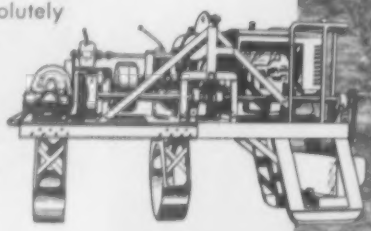

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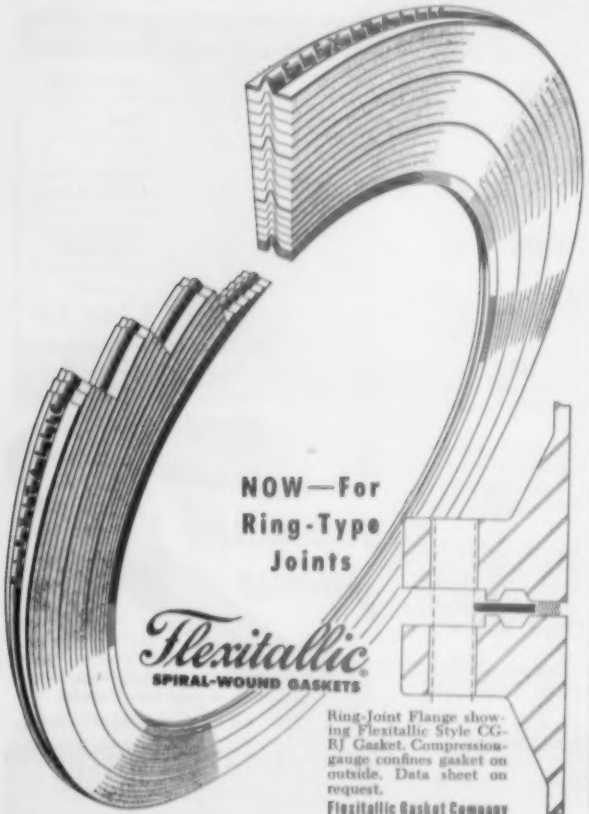

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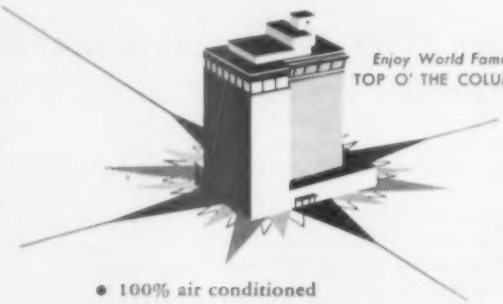

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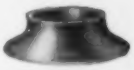

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PIPE LINE SURVEYS

Pipeline Patrol

pipe size, and terminal point pending final report by Shell.

Trans Mountain Oil Pipe Line Co.—Company has awarded contract to Engineers Limited Pipeline Co. to build 15 miles of 20-in. and 11 miles of 16-in. line. Both lines run from Sumas, B. C., to General Petroleum's refinery which is being built at Ferndale, Wash.

• **Union Oil Co. of California.**—Planning construction of a 60-mile crude line from its Clara Valley field to its Wilmington refinery. Line is expected to be completed by late this year. Size not yet determined. Engineering work under way.

• **West Coast Pipeline Co.**—960 miles, 24-26-in., planned. Wink, Tex., to Norwalk, Calif. $106,000,000.

Products Pipelines

American Pipe Line Co.—Line planned from Gulf Coast area to New York City area.

Badger Pipe Line Co.—215 miles, 8-10-12-in., begin Spring '54, East Chicago, Ind., to Madison, Wis. (Joint project of Cities Service Oil Co., Sinclair Pipe Line Co., Pure Oil Co., and The Texas Co.)

• **H. W. Bass & Sons, Inc.**—152 miles, 4-6-in., proposed. Duval and Live Oak counties, Texas, to Corpus Christi, Tex.

• **Frontier Ref. Co.**—215 miles, 6-in., planned, Cheyenne, Wyo., to North Platte, Neb.

Great Lakes Pipe Line Co.—Under way extension 130 miles, 8-in., Nebraska City to Grand Island, Neb. R. H. Fulton Const. Co.

• 150-miles, 8-in. to run from Iowa City, Iowa to Prophetstown, Ill., and to tie in to the Badger system there.

• 189 miles of 12-in. to run from Kansas City to Des Moines.

• 98 miles of 12-in. from Rosemount to Willmar, Minn.

• 63 miles of 12-in. from Willmar to Alexandria, Minn.

• 105 miles of 8-in. from Alexandria to Fargo, N. D.

• **International Pipe Line, Inc.**—132 miles, 8-in., proposed, Wrenshall to Minneapolis, Minn.

• **Oil Basin Pipeline Co.**—230-mile, 8-in. products line planned from Laurel, Mont., through Billings to Glendive, Mont. Construction tentatively set to start as soon as weather permits with completion set for late summer. Est. cost: $5,350,000.

Oklahoma Mississippi River Products Line, Inc.—475 miles, 10 and 12-in., under way, Duncan, Okla., to West Memphis, Ark. Ford, Bacon & Davis Const. Corp.

Under way, White River to Allen, Okla. River Const. Co. Completion date 6-30-54.

Under way, Allen to Duncan, Okla. River Constr. Corp. Completed.

• **Phillips Petroleum Co.**—54 miles, 6-in. planned, Goldsmith to Borger, Tex.

52 miles, 10-in., planned, Shell's Brookshire system to Sweeny, Tex.

Shell Pipe Line Corp.—65 miles of 12-in. products line from Baton Rouge, La., to Shell's Norco refinery. Houston Contracting Co. has contract. H. T. Muckley, Supt.

• **Triangle Pipe Line Co.**—560 miles, proposed, Arkansas City, Ark., to Covington, Ky., and Nashville, Tenn.

U. S. Gov't. Alaskan Products Pipe Line.—600 miles, 8-in., under way, Haines northward through British Columbia and Yukon to Fairbanks, Alaska. Williams Bros., McLaughlin, Inc., and Marwell Const. Co. Completion date 9-55.

Yellowstone Pipe Line Co.—(Continental Oil Co., Interstate Oil Pipe Line Co., Union Oil Co., and H. Earl Clack interest) 531

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Pipeline Patrol

miles, 10-in., under way, Billings, Mont., to Spokane, Wash. 9-54. Est. cost: $20,500,000.

Billings to Bozeman, Mont. Ross and Powers. Comp. 133 miles, 8-31-54.

Bozeman to Helena and on to Clinton, Mont. Associated Pipe Line Contractors, Inc. Completed. 94 miles 6-15-54.

Clinton to Perma, Mont. Associated Pipe Line Contractors, Inc. 69 miles 8-31-54.

Clinton to Perma, Mont. Eastern Pipe Line Fields Service Co. 76 miles. Completed.

Perma, Mont., to Murray, Idaho. Eastern Pipe Line Field Service Co. 74 miles 7-1-54.

Murray, Idaho to Spokane, Wash. Engrs. Limited Pipe Line Co. 85 miles 7-1-54.

Natural-Gas Pipelines

• **American-Louisiana Pipe Line Co.**—1,121 miles of 30 and 22-in., 30-in., proposed, extends from North Tepetate, Acadia Parish, Louisiana, to near Detroit. The 22-in. starts near Payne, Ohio, extends to Bridgman, Mich. Estimated cost: $130,000,000.

• **Arkansas Louisiana Gas Co.**—108 miles of new line proposed, to be added to present system in Arkansas, Louisiana, and Texas. Estimated cost: $9,245,166.

• **Atlantic Seaboard and Virginia Gas Transmission.**—116 miles, 26-in., proposed, loops along Cobb, W. Va., to near Baltimore, Md. Start May 1.

• **Carolina Natural Gas Corp.**—185 miles, 2-12-in., proposed, lateral lines off Transcontinental in North and South Carolina.

Chicago District Pipe Line Co.—19 miles of 36 and 30-in., completed of 35 miles planned. Remainder, all 30-in., will be completed in 1954.

• **Cities Service Gas Co.**—24 miles of 26-in. proposed, to replace two existing 16-in. lines in Franklin and Johnson counties, Kansas.

Nine miles of 20-in. to replace existing 16-in. line in Cherokee and Jasper counties, Missouri.

• **City of Dalton, Ga.**—Proposes to build 39 miles of 8-in. from a point of interconnection with Southern Natural's Rome-Calhoun transmission line. Estimated cost: $2,940,000.

• **City of Fayette, Ala.**—20 miles, 5-in., FPC approved, Fayette, Ala., to Southern Natural's system in Tuscaloosa County, Alabama. Completion set for early 1955.

City of Dallas, Ga.—56 miles of 8 and 4½-in., distribution system. Engineering & Const. Co. Completion June 1954.

• **Coast Counties Gas & Electric Co.**—40 miles, 3, 4, and 8-in., planned. Coast and Valley region, California.

• **Colorado Interstate Gas Co.**—365 miles, 22-in., proposed, Green River, Wyo., to Denver, Colo. 1954.

49 miles, 20-in., under way, Morton County, Kansas, to near Hooker, Okla. Estimated cost: $3,999,000. R. H. Fulton Const. Co.

• **Colorado-Western Pipe Line Co.**—454 miles of undetermined size pipe planned between Cortez in Montezuma County and Denver. Line would serve towns of Montrose, Gunnison, Salida, Fairplay and South Platte, Colo. Estimated cost: $30,000,000. Company also plans 254 miles of laterals to service Colorado cities not now receiving natural gas.

328-mile line, proposed, to run from a point in La Plata County in southwestern Colorado over the Continental Divide along the eastern slope to serve Pueblo, Colorado Springs, and Denver. Estimated cost: $21,600,000.

• **Dixie Pipe Line Co.**—Proposed 20-mile, 8-in., line from Gwinville field to connection with Transcontinental Gas Pipe Line Corp.'s existing transmission line in Jefferson Davis County, Mississippi. Est. cost: $425,000.

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Pipeline Patrol

El Paso Natural Gas Co.—1,178 miles under way, Permian basin, New Mexico, Texas and Colorado. Spring '54.

El Paso Natural Gas Co.—771 miles, 30 in., under way, Plains, Tex., to Kingman, Ariz.

Section 1—Under way, Plains, Tex., to Corona, N. M. Oklahoma Const. Co.

Section 2—Under way, Corona to Suwanee N. M. R. H. Fulton.

Section 3—Under way, Suwanee to Gallup N. M. R. H. Fulton.

Section 4-5—Under way, edge to Navajo Reservation east to Flagstaff on to Kingman, Ariz. Western Pipe Line Const., Inc. Completion date 2-54.

Under way, across Navajo Reservation connecting sections 3, 4, and 5. El Paso Co crews.

Under way, Spraberry fields, El Paso Co crews.

• **El Paso Natural Gas Co.**—20 miles of 10¾-in. proposed from Warren Petroleum Corp.'s Saunders plant in Lea County, New Mexico, to connection with El Paso's existing 30-in. line in Lea County.

• **Fort Worth Basin Gas Co.**—Planned Novice, through Brown and Comanche counties, Texas.

• **Glacier Gas Co.**—285 miles, 20-in., proposed, Kalispell, Mont., to Spokane, Wash.

120 miles, 16-in., proposed, Spokane to Hanford, Wash.

91 miles, 8⅝-in., proposed, Spokane to Lewiston, Idaho.

130 miles, 12¾-in., proposed, Spokane to International boundary at Trail, British Columbia.

Gulf Interstate Gas Co.—860 miles, 30-in. under way. Acadia Parish, La., to Boyd County, Ky. H. C. Price and Houston Contracting. 11-54.

Houston Contracting Co., Ltd., has completed 370 miles of its 500-mile contract from Rayne, La., to Kinkade, Tenn. Three spreads which have been working on the job are presently overhauling equipment and will not resume work until spring. Spread 1, headed by E. C. Norris, has completed 165 miles from the Mississippi River northward and it will resume work this spring.

Spread 2, headed by F. A. Silar, has completed 117 miles from the Ouachita River southward into the inception point of Rayne.

Spread 3, headed by M. L. Thompson, has completed 88 miles from the Ouachita River northward to the Mississippi River. It will begin work in the spring at the terminus of Kinkade, going south to join with Spread 1.

The remaining 360 miles is under contract to H. C. Price Co., Bartlesville, Okla. The firm has completed 279 miles and has 81 miles remaining which will be started in the spring. Five spreads, headed by G. A. Reutzel, R. L. Ezell, C. E. Shivel, and W. H. Olrich, have done the work. Price's contract covered the line between Gordonsburg, Tenn., and Catlettsburg, Ky.

Under way, Rayne, La., to Kincade, Tenn. Houston Contr. 370 miles laid. 130 miles left to be finished Spring of 1954.

Under way, Gordonsburg, Tenn., to Catlettsburg, Ky. 266 miles completed, 91 miles left.

230 miles, gathering lines, under way. Associated Pipe Line Contractors, Anderson Bros., Williams Bros.

329 miles, 12 to 24-in., proposed. Laterals off Acadia Parish, Louisiana, to Boyd County, Kentucky, line.

• **Home Gas Co.**—Asking for bids on 24 miles of 12-in. from Halsey Valley to Westover, N. Y.

Also asking for bids on 25 miles of 12-in. from Port Dickinson to Deposit, N. Y.

Iroquois Gas Corp. and Tennessee Gas

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Pipeline Patrol

Transmission Co.—Companies planning joint storage project to be known as Colden storage field in New York. The following delivery and gathering lines are planned:

17 miles, 16-in. delivery line.

62 miles, 12, 8, 6, and 4-in. gathering lines.

• **Iroquois Gas Corp.**—25 miles of 20-in. line, approved by FPC, from Iroquois' Porterville station near Elma, N. Y., to Tonawanda, N. Y. Est. cost: $1,540,000.

Kansas-Nebraska Natural Gas Co., Inc.—Proposes to construct 206 miles of 6-12-in. pipeline to add to present system in central and northeastern Nebraska.

• **Lateral Gas Pipe Line Co.**—27 miles, 4½ in., proposed, from Grant to Clarinda, Ia. Estimated cost: $267,200.

• **Manufacturers Gas Light & Heat Co.**—40 miles, proposed, Allegheny, Washington, and Beaver counties, Pennsylvania.

213 miles, 3 to 26-in., proposed, various points on system in Pennsylvania, West Virginia, and Ohio.

72 miles, 16-20-in., proposed, Doddridge, Wetzel and Marshall counties, West Virginia.

• **Michigan Consolidated Gas Co.**—25 miles, 12-in., proposed, from near Sparta to Muskegon, Mich.

• **Michigan Wisconsin Pipe Line Co.**—251 miles, proposed, 24, 18, 12, 6, and 4-in. loops. Majority will be in Wisconsin.

Missouri Central Gas Co.—25 miles, 6-in., proposed, Moberly to Macon, Mo.

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• **Missouri Public Service Co.**—136 miles, 8-10-in., proposed, New Franklin to Trenton, Mo.

24 miles, 10-in., Johnson County to Clinton, Mo. FPC approved. Est. cost: $600,000.

• **Montana-Dakota Utilities Co.**—Proposes to build 56 miles of 2, 4, and 6-in. line from its 12-in. Cabin Creek-Bismarck line near Gladstone, N. D., to the towns of Lefor, Regent, New England, and Mott, N. D.

• **Natural Gas Producer, Inc.**—100 miles, 12-in., planned, Yenter pool to Denver, Colo.

• **New River Gas Co.**—50 miles, planned, Summers to Monroe counties, West Virginia, to Narrows and Dublin, W. Va.

• **North Dakota Gas Transmission Co.**—470-mile line from Tioga plant of Signal Oil & Gas Co. and Beaver Lodge field to Fargo and Grand Forks, N. D. Line will have 78 miles of 12-in., 215 miles of 10-in., 70 miles of 8-in., and 107 miles of 6-in. Estimated cost: $10,800,000.

• **Northern Indiana Fuel & Light Co.**—35 miles, 8-in., planned, Edgerton to Auburn, Ind.

Northern Natural Gas Co.—Midwestern Constructors, Inc., has two jobs for company. No. 1 is 94 miles of 30-in. pipeline consisting of five loops (one in Texas, one in Oklahoma, and three in Kansas). No. 2 is 95 miles of 30-in. pipeline consisting of six loops (one in Kansas, one in Nebraska, three in Iowa, and one in Minnesota).

• 167 miles of 24-in. line proposed to run from Farmington, Minn., to Duluth. Est. cost: $12,195,300.

• **Northwest Alabama Gas District**—40 miles, 9-in., proposed, Southern Natural's line through Windfield to Haleyville, Ala.

Northwest Natural Gas Co.—665 miles of unannounced size pipe to bring gas from Alberta, Canada, to the "Inland Empire" of northern Idaho and eastern Washington. Estimated cost: $36,000,000.

• **Ohio Fuel Gas Co.**—31 miles, 20-in., planned, Licking County to Richland County, Ohio.

22 miles, 16-in., planned, Dayton, Troy, Piqua, and Sidney, Ohio.

23 miles, 16-20-in., planned, Wellington to Elyria, Ohio; 16 miles, 20-in., planned, Benton Station to Crawford Station; 18 miles, 20-in., Crawford Station to near Columbus; 16 miles, 16-in., planned, Berlin to Sandusky, Ohio.

74 miles, 3 to 20-in., planned, Hocking, Knox, and Ashland counties, Ohio.

47 miles, 20-in., planned, Benton Township, Hocking County, to Columbus, Ohio.

61 miles, planned, northern and southwestern Ohio.

33 miles, 20-in., proposed, Jefferson to Seneca, Ohio.

69 miles, 20-24-in., proposed, lines to tiein Gulf Interstate line along various points in Lawrence, Jackson, Vinton, Hocking and Fairfield counties, Ohio.

Pacific Gas & Electric Co.—200 miles, 34-in., planned, paralleling Topock-Milpitas line. 107 miles contracted to Engineers Limited Pipe Line Co. L. E. Robertson is in charge of the spread handling work from Newberry to Danby and from Los Muertos Creek to Gilroy, Calif.

15 miles, 20-in., planned for completion in 1955 from Helm Tap to Helm Junction, Calif. Alex Robertson Co.

15 miles, 12-in., planned for completion in 1955. From Herndon to Madera, Calif. Company forces.

13 miles, 16-in., scheduled for completion in 1954. From Fairfield to Napa Wye, Calif. M.G.M. Construction Co.

30 miles, 10-in., scheduled for completion in 1954. From Corning field to Chico, Calif. Company forces.

19 miles, 16-in., from Wild Goose field to Yuba City, Calif. Scheduled for 1954 completion by company forces.

Pipeline Patrol

• **Pacific Northwest Pipeline Corp.**—1,466 miles, proposed, Ignacio, Colo., to Bellingham, Wash.

380 miles, proposed, laterals and spurs off main line to Pocatello, Idaho, to Yakima, Wash.

• **Pine Tree Natural Gas Co.**—204 miles of undetermined size pipe to run from the Boston area to Bangor, Me.

• **Shenandoah Gas Co.**—40 miles, 3-4-8-in., proposed, Middleton, Va., to Martinsburg, W. Va. Est. cost: $1,470,000. FPC approved.

• **South Georgia Natural Gas Co.**—339 miles, 2-12-in., planned, Phoenix, Alta., to Tallahassee, Fla. (a) 12-in., Phoenix, Ala., to Albany, Ga., (b) 10-in., Albany, Ga., to Moultrie, Ga., (c) 8-in., Moultrie, Ga., to Tallahassee.

• **Southeast Alabama Gas District.**—150 miles, 10 and 8-in., planned, Phoenix City to Dothan, Ala. Engineering Const. Co. Start summer 1954.

• **Tennessee Gas Transmission Co.**—574 miles, 30-in., planned, Kinder, La., to Portland, Tenn.

63 miles, 26-in., planned, loops in Ohio and Pennsylvania.

45 miles, 20-in., proposed, Buffalo, N. Y., to the U.S.-Canadian border near St. Catherines.

243 miles 24-in., planned, Coudersport, Pa., eastward across Pennsylvania, New Jersey, and New York to point near Greenwich, Conn.

• **Texas Eastern Penn-Jersey Transmission** Corp.—265 miles, 24-in., approved by the FPC from Oakford Storage field in western Pennsylvania to Texas Eastern Transmission Corp.'s Compressor Station No. 26 near Lambertville, N. J. Est. cost: $30,755,000.

• **Texas Gas Transmission Corp.**—48 miles, 26-in., planned, loops from Memphis to Slaughters, Ky.

24 miles, 16-in. line proposed from North Tepetate field, Acadia Parish, Louisiana, to South Roanoke field in Jefferson Davis Parish, Louisiana.

• **Texas-Ohio Gas Co.**—1,435 miles, 30-in., proposed, Hidalgo County, Texas, through Arkansas, Mississippi, Tennessee, and Kentucky on to Spencer, W. Va.

• **Transcontinental Gas Pipe Line Corp.**—421 miles, 30-36-in., looping along Texas-New York line.

19 miles of 12.75-in. pipe starting at West White Lake field in Vermilion Parish, Louisiana, and connecting with applicant's transmission line in same parish. Estimated cost: $1,042,310.

• 57 miles of 36 and 30-in. paralleling sections of its existing system in Louisiana, Mississippi, and Alabama. Approved by FPC. Est. cost: $6,533,000.

• **Trans-Northwest Gas, Inc.**—246 miles, proposed, International Boundary near Osoyoos, B. C., to Washington and Idaho.

275 miles, branch lines.

• **Trunkline Gas Co.**—Proposes to cross the Mississippi River with two 24-in. lines near Greenville, Miss. Est. cost: $2,960,000.

• **United Fuel Gas Co.**—52 miles, 20-24-in., proposed, Wood County to Lanham, W. Va. Spring 1954.

57 miles, 30-in., proposed, Lanham in Kanawha County, West Virginia, to Gulf Interstate line in Boyd County, Kentucky Spring '54. C. R. Ice, spreadman.

United Gas Pipe Line Co.—44 miles, 20-in., under way, Lirette field to Harvey, La Brown & Root.

Utah Natural Gas Co.—Planning 40 miles from Orem to Salt Lake City, 16-in. pipe at later date. Contract not let yet.

Virginia Natural Gas Co.—153 miles, Buckingham to Richmond and Portsmouth, Va

Warren Pipe Line Co.—25 miles of 3-20-in.

a *Quick* make and break union

Precision built of forged steel with cold working pressures from a vacuum to 3000 pounds and maximum temperature of 500 degrees F. (with special "O" Ring).
The ends and nut are octagon in shape. The ends are tapped to Briggs Standard steam threads.
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Nut threads are rust-proof, spark-proof, and permanently lubricated with Udylite Cadmium.
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HANDLE-BAR "O" RING QUICK TYPE UNIONS

These unions are volume produced from forgings to finished union in our own plant to provide price and performance at its best. They do not depend upon compression or force as the terms relate to common gasket type unions. Hand tightening of nut will hold rated pressure. "O" Ring unions are recommended for mud, cementing, crude oil, lube oil, natural gas and water and vacuum services. Excellent for acidizing, fuel oil, kerosene and gasoline.

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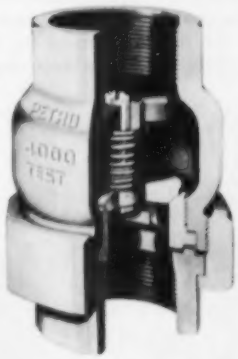

These valves work in any position, vertical, horizontal or upside down. The spring controls opening and closing of poppet valve in accordance with the volume and velocity of the flow. These valves are highly recommended for steam, water, hot or cold oil, gas, gasoline and process lines. Excellent as a discharge valve on reciprocating pumps. Petro, Hydro or Handle-Bar are Udylited and available with bronze or stainless steel seats.

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Pipeline Patrol

being laid in Garvin County, Oklahoma, by George W. Davis Co. Completion date not set.

Westcoast Transmission Co., Ltd. — (See foreign natural gas pipe lines).

Foreign Crude-Oil Pipelines

● **Arabian American Oil Co.**—18 miles, 22-20-in., planned, Qatif to Ras Tanura No. 1. Completion date 1-55.

Bombay Port Trust.—50 miles, 8 to 24-in., contracted, Bombay, India, to serve Standard Vacuum Oil Co., and Burmah Shell refineries. Merritt, Chapman & Scott Corp., contractors. (Crude and Products). Collins Const. Co. has subbed 84,000 ft. of Subaqueous work.

Creole Petroleum Corp.—21 miles, 34-in. crude line to run from Lagunillas field to La Salina, Venezuela. Williams Brothers Overseas Co. has contract with construction slated to start in February and to be completed in 6 months. Line when completed will be the world's largest-diameter crude line.

Direccion General de Yacimientos Petroliferos Fiscales—409 miles, under way, Plaza Huincul to Bahia Blanca, Argentina.

Estrada De Ferro Santos A Jundiai Oleoduto Santos—Sao Paulo.—This Brazilian company has completed or recently started the following lines:

2 miles, 24-in. crude line from Junction to Refinery at Capuava. Completion, May 1954.

21 miles, 12-in., planned from Cubatao to Capuava refinery. Completion scheduled for June 1954.

● **Gaz de France**—200 miles, 12-in. Ruhr to Paris, France.

Interprovincial Pipe Line Co. and Lakehead Pipe Line Co.—Contracts have been awarded for 604 miles of looping; 454 miles will be in Canada, the remaining 150 miles will be in the United States.

201 miles of 24-in. between Regina and Gretna, Man., have been awarded to Anderson International Contractors, Ltd., of Edmonton, Alta.

Mannix, Ltd., of Calgary, Alta., will lay 129 miles of 24-in. line between Edmonton and the Alberta-Saskatchewan boundary.

Fulton-Bannister, Ltd., has contract for 125 miles of 24-in. line to connect the lines being built by Anderson and Mannix.

R. H. Fulton & Co., of Lubbock, Tex., has the contract for 104 miles of 26-in. looping from the Canadian border southeast. Anderson Bros. Corp. has contract for 50 miles of 26-in.

● **Mid-Saskatchewan Pipelines, Ltd.**—Proposed line from Smiley Viking oil field to connect with Interprovincial Pipe Line Co.'s Kerrobert pump station.

● **Pembina Pipe Line Co., Ltd.**—Company has permit to build 325 miles of 3-12-in. gathering line from Pembina field and a 72-mile, 16-in. transmission line to the terminals of Trans Mountain Pipe Line Co. and Interprovincial Pipe Line Co. at Edmonton, Alta.

● **Petroleos Mexicanos.**—145 miles, 12-in., considered, 18 de Marzo field via Reynosa to Monterrey, Mexico.

100 miles, planned, Ishthmus of Tehuantepec, Jose Colomo to El Plan field, Minatitlan.

72 miles, 12-in., proposed, Poza Rica to Atzacapotzalco, Mexico.

Petroleos Mexicanos.—125 miles, 10-in., under way, Jose Colomo to El Plan, Mexico.

● **Saskatoon Pipe Line, Ltd.**—56 miles, 6-in., planned, Milden to Saskatoon, Sask.

Texas Petroleum Co. — 60 miles, 4-6-in., under way. Pta. Nino de La Dorada.

Texas Petroleum Co.—Contract has been let to Foster Wheeler Corp. and Panama-Williams for a 119-mile 12-in. crude line to move oil from Velasquez field in Colombia to a connection with the main Andian National system at Galan. Est. cost: $6,000,000.

Pipeline Patrol

• **Yacimientos Petroliferos Fiscales Bolivianos.**—170 miles, 4-in., planned, Bermejo to Tupiza, Bolivia.

Foreign Products Pipelines

Anglo-Iranian Oil Co., Ltd.—18½ miles, 16-in., under way, Little Aden to Aden. Bechtel Corp. Completion date December 1954.

18½ miles, 6-in., under way, Little Aden to Aden. Bechtel Corp. Completion date December 1954.

15 miles, 12-in., under way, Kwinana to Fremantle, M. W. Kellogg Co. Completion date February 1955.

17 miles, 6-in., Kwinana to Fremantle. M. W. Kellogg Co. Completion date February 1955.

• **Empresa Nacional del Petroleo**—80 miles, 6⅝-in., planned, Concon to Santiago, Chile.

• **Governments of Southern Rhodesia and Portuguese East Africa.**—200 miles, considered, Beria, Portuguese Mozambique to Umtalia, Southern Rhodesia.

North Atlantic Treaty Organization (NATO)—1,920 miles, 4-10-in., to serve military bases in Western Europe (to connect with U. S. Government's St. Nazaire-Paris-Metz line.) Contracted by Soc. Foster Wheeler Francaise.

• **Petroleos Mexicanos.**—124 miles, 6-in., planned, Lagos to Guadalajara, Mexico.

54 miles, 6-in., planned, Lagos to Aguascalientes, Mexico.

82 miles, 8-in., planned, Salamanca to Lagos, Mexico.

• **United States Government.**—375 miles, 12-in., planned, St. Nazaire to Melun and Metz, France.

• **United States Navy Department.**—Proposed 300-500-mile line to be built in Spain to serve a proposed naval base and four large air bases which are also proposed under a defense agreement with the Spanish Government. No definite size or cost is known now.

Foreign Natural-Gas Pipelines

Azienda Generale Italiana Petroli—90 miles, 12-in., under way, Cortemaggiore to Bologna, Italy, SNAM crews.

120 miles, 16-in., under way, Cremona Porto Mar to Ghera, Italy, Montubi, contractor.

40 miles, 12-in., under way, Ripalta-Bergamo, Italy.

• **Burma Oil Co., Ltd.**—350-mile, 16-in. line planned from Sui field to Karachi in West Pakistan. Estimated cost: $25,000,000.

Direccion General del Gas del Estado—310 miles, 8-in., under way, Plaza Huincul to Neuquen, Argentina, to the vicinity of General Conesa, Argentina.

• **Empresa Nacional del Petroleo**—80 miles, 10-in., planned, Concon to Santiago, Chile.

• **Northwest Natural Gas Co.**—950 miles, 24-in., planned, Alberta fields to Vancouver, B. C., Seattle, Wash., and Portland, Ore.

Petroleos Mexicanos.—205 miles, 16-in., under way, Monterrey to Torreon, Mexico.

• **Petroleos Mexicanos.**—440 miles, 20-in., planned, Brazil to Tampico to Poza Rica, Mexico.

• **Tennessee Gas Transmission**—75 miles of undetermined size pipe proposed from Buffalo to Toronto. Proposal passed Canadian Senate will go before parliament probably in April 1954.

• **Trans-Canada Pipe Lines, Ltd., (Canadian Delhi Oil Co.)**—2,247 miles, 14 to 30-in., proposed, Alberta to Toronto to Montreal.

747 miles, 8 to 24-in., gathering system in Alberta.

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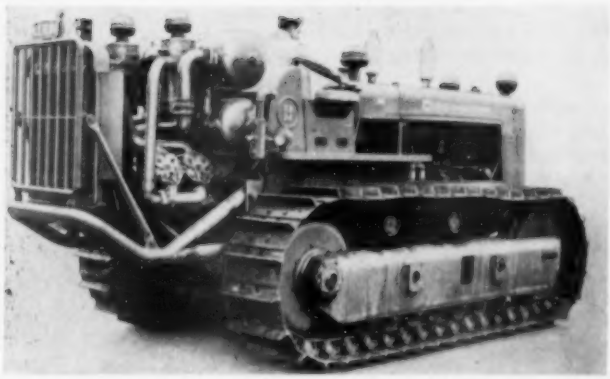
by Dan B. Miller



Compressor Adds Utility to Tractors

Pipeline and heavy construction contractors can use the 600 CTM (compressor tractor mounted) to bring compressed air power to the most remote areas. The compressor with side booms and twin wagon-drill air-feed assemblies can convert retired tractors into fast moving, integral drilling units. This 600-cu.-ft per minute compressor can be readily mounted on two makes of crawler tractors, the International Harvester TD 24 and Caterpillar D 8.

A crawler with weak, worn tracks, incapable of producing enough traction for dozing or scraping operations, usually has a good sound engine worth saving. By mounting this compressor on such a tractor, a newer crawler will be relieved of the expensive job of towing a four-wheel portable compressor. Drilling pace is accelerated by greater mobility. Since the same engine powers both tractor and compressor, fuel economies will result.

Standard equipment includes an independent clutch to disengage compressor from power-takeoff shaft, deep crankcase for operation at 30° angle, complete compressor controls including slowdown of engine, heavy undercarriage and intercooler guards. *Le Roi Co.*

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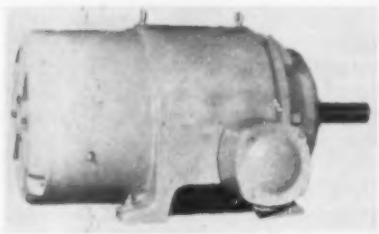

Motor Line Expanded to Include 150-Hp. Model

Maximum ratings available of U. S. horizontal totally enclosed and explosionproof motors have just been increased to 150 hp. The motor, known as Type SD, is designed for protection against dirt, moisture, oil, and chemicals. The explosionproof motor, Type SE, is designed for service where inflammable gases or volatile liquids may be present. Type SE motors are supplied with the Underwriters' Laboratories label for Class I—Group D, and Class II—Groups F and G.

Both type motors are double enclosed with a built-in fan for full ventilation and greater heat dissipation. Additional feautres include asbestos-protected windings to withstand high temperatures; stator cover plate which can be easily removed for inspection or cleaning; solid, dynamically balanced, cast aluminum rotor; Lubriflush bearings for relubrication without disassembly; and normalized castings for permanent machining accuracy.

These motors are now available from ½ to 150 hp. They may also be supplied in combination with the wide range of Varidrives when variable speeds are desired, or on Syncrogears when geared multiplied torque is needed. *U. S. Electrical Motors, Inc.*

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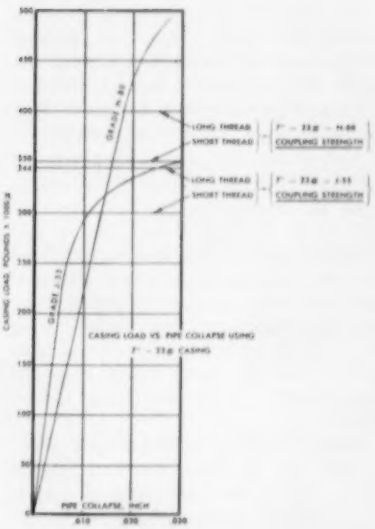

New Heads and Hangers Hang Any Casing Weight

New lines of improved casing heads and hangers safely hang any weight of casing strings to full coupling strength, and eliminate dangerous bottlenecking.

These "S" (step) heads and hangers are recommended for use in wells of all depths. Casing strings may now be designed and hung to full pipe strength, allowing the coupling strength to determine the length of casing string, or the load which may be applied with complete safety and dependability. The accompanying performance curves show operational characteristics. *McEvoy Co.*

Check No. 3 On The Time Saver Card

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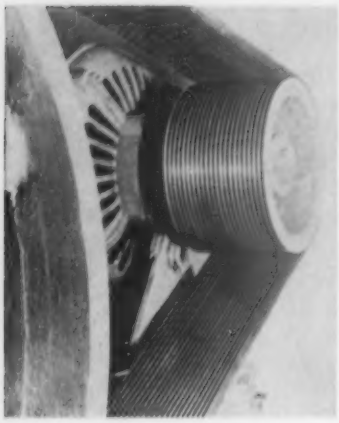
What's New... Use the handy Time-Saver Cards



Poly-V Belt Provides Greater Contact Area

The Poly-V belt, a single, endless rubber belt with a series of parallel V-ribs molded lengthwise around the inside circumference, has an uninterrupted, high-strength member of synthetic cords across its entire width.

Poly-V sheave grooves are designed to mate precisely with the belt ribs, and since the belt covers the full width of the drive member, the load is distributed equally over the entire driving surface. This provides twice the contact area of a comparable multiple V-belt application so that Poly-V drive gives up to 50 per cent greater horsepower with the same width, or equal horsepower with a third less sheave width.

Design features of the Poly-V drive reduce face pressure one-half, giving longer life to belt and sheaves. Also, the full drive width and the total traction-surface contact prevents belt turnover and progressive sinking in sheave grooves. One of the most important features of the new drive is that it eliminates belt matching problems. *Manhattan Rubber Division, Raybestos-Manhattan, Inc.*

Check No. 4 On The Time Saver Card

●

Nonsparking Torpedo Tube Is for Deep-Well Blasting

A new self-contained, charged, nonsparking torpedo tube is for deep-well blasting. The Saf-T-Pak is a laminated tube about 10 ft. long, made of kraft and asphalt papers, and serves as its own shipping container. The top end of the tube is crimped and the other end has a sectionalized pointed nose.

A flexible, high-strength, stranded galvanized wire forms a lowering bail at the crimped end which runs through the inside of the tube to the nose end where the protruding wires are securely tied around the nose and joined by a nonsparking metal clamp. The torpedo tube is constructed so that the flexible cable, which has a breaking strength of 1,200 lb., is never exposed to the sidewalls of the bore hole during loading.

Saf-T-Pak tubes, made in two diameter sizes, are charged with four container cartridges of 80 per cent strength Nitro Oil Gelatin No. 2. The 5¼-in. tube has an explosive column of 5 in. in diameter and weighs 100 lb.; the 4¼-in. tube has an explosive column of 4 in. in diameter and weighs 66⅔ lb. Two or more tubes may be clamped together to form a 200-lb. charge. *American Cyanamid Co.*

Check No. 5 On The Time Saver Card

●

Tubing Drain Designed for Use on Unanchored Tubing

This hydraulic releasing tubing drain is designed particularly for use in shallow fields where the tubing is generally unanchored. The tubing can be drained in a matter of minutes simply by applying additional pressure at the surface with a hand pump. When approximately 1,000 lb. pressure has been applied, the hydraulic piston in the drain overcomes a shear-pin which allows the fluid column to drain out at a restricted flow.

Two important advantages are achieved when a well is equipped with this drain: wet jobs and stripping jobs become a thing of the past, minimizing fire hazards and undesirable working conditions; and the fluid column can be drained back into the well under a restricted flow thus avoiding the severe hydraulic action applied to the formation under conventional procedures.

The Type B drain features a replaceable shearing unit which gives longer life to the tool. This unit houses a hydraulic piston, shear-pin, and O-ring seals. Its purpose is to confine the cutting action of the fluid to its interior thus protecting the main body of the drain. It is held securely in place.

The unit is available in 11 pressure settings in tubing sizes from 2 to 4 in. *Page Oil Tools, Inc.*

Check No. 6 On The Time Saver Card

●

Big Pumping Unit Features Design Improvements

Features of these 1954 pumping units include a newly designed adjustable counter-balance; bronze-bushed four-way adjustable saddle bearing, choice of helical or herringbone gears; safety type horsehead; and automotive type brake. Of particular interest is the counterbalance which can be adjusted by one man on the ground in a matter of minutes. Crank calibration locates weights for desired counterbalance. Weights cannot fall during adjustment. They are locked and held in position at all times. *Alten Foundry & Machine Works, Inc.*

Check No. 7 On The Time Saver Card

●

Tubing Completion Method Gives Deep Penetration

A new method of tubing type well completion, using full size Glass Jet perforating charges, utilizes any one of three regular Glass Jet perforators with steel strip carriers, standard casing, super casing, or super formation Glass Jet.

The perforator is attached to the bottom of the production tubing and is run in the well on the tubing to the desired depth. The surface control equipment is then installed and the flow lines hooked up.

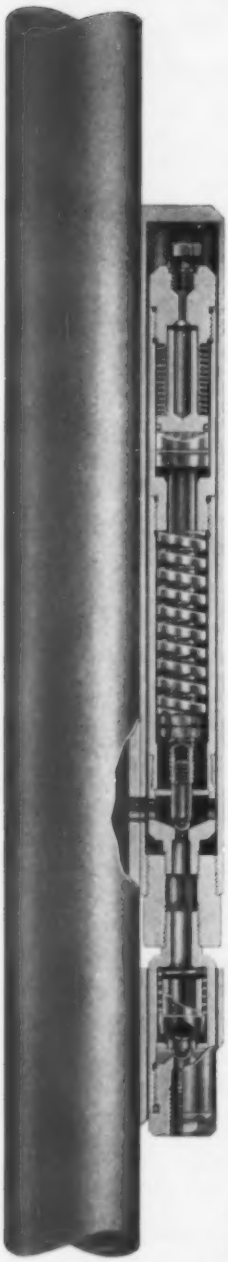
The Glass Jet perforator is fired. After firing, the electric firing probe is removed from the well. The expendable steel strip carrier remains in the well. The well flows through the

THE NEW MACCO VALVE

TRADE MARK — TIME TESTED — MACCO — GAS LIFT — REG. U. S. PAT. OFF.

SPRING LOADED

FLUID OPERATED



Patent Applied For

Features:

- "No charge" bellows—with spring tension set as valve pressure.
- The bellows function only as a diaphragm, and the spring functions as the total actuating force.

Advantages:

- Since there is no bellows charge, temperature changes in the well do not affect the opening pressure of the spring-loaded valve. Hence, the opening pressure of the valve is known regardless of the operating depth, and installations may be designed accordingly.
- The "no charge" bellows are subjected to pressure in only one direction and, therefore, have a longer life expectancy than ever before.
- When once a valve opening pressure is set by spring tension, the pressure remains unchanged regardless of hydrostatic pressure or temperature applied to the valve in the well.
- This new valve may be easily readjusted in the field, utilizing only ordinary wrenches.
- Since the spring in this valve is the total actuating force, the valve may be set with either extremely high or low opening pressure. It, therefore, has a much wider operating range than valves made in the past.
- Should the bellows become damaged after the well is unloaded, the valve remains closed and other valves continue to operate. Hence, a well will continue to be efficiently lifted even with a valve or valves out of service.

THE NEW MACCO SPRING-LOADED, FLUID-OPERATED VALVE HAS ALL THE FEATURES AND ADVANTAGES OF THE PRESENT MACCO FLUID-OPERATED VALVES, *PLUS THE ADVANTAGES LISTED ABOVE.*

Telephone, write or wire

MACCO OIL TOOL CO.

1521 PRINCE • HOUSTON 8, TEXAS • TELEPHONE UN-1253

open-end tubing entirely unrestricted, since no operating mechanisms are left in the hole.

The operator gains the advantage of maximum jet power and deepest penetration. It eliminates the use of small perforating charges which must be used when a special perforator is run through the inside of tubing. Another important feature is that nearly any length of steel strip carrier may be used, with anywhere from one to four shots per foot. The strip carrier may be loaded full length, or sections may be left unloaded so as to perforate only selected intervals. The entire perforating job is accomplished at one time, even multiple-zone completions, because all shots are fired simultaneously. *McCullough Tool Co.*

Check No. 8 On The Time Saver Card

●

Spectrum in Oilscope Is Closely Controlled

Oilscope is a tool specifically designed and produced for the petroleum industry. Its function is to accurately and simply confirm or deny the presence of oil in samples of cuttings or cores as they are taken from drilling wells. This is accomplished by exposing these samples to the rays of a lamp which will produce the required amount of radiation intensity to activate the fluorescence in oils.

Radiation intensity is deliberately held to a minimum through a process of reflection, absorption and filtration. In fact the spectrum is so closely controlled that dead oil will not fluoresce. The relative intensity of the wave length is less than 10 per cent of the possible spectrum.

Operation of the Oilscope is simplicity itself. Oils fluoresce in the various shades of green, from a very dark green to a silver-greenish cast. Ether cuts will fluoresce from a light bluish milky green to a dark milky green. The degree of fluoresence and color density depends on the amount of saturation contained in the sample. *Field Tool Co.*

Check No. 9 On The Time Saver Card

●

New Method Prevents Fluid Loss in Cores

Cores arrive at the laboratories in just the way they arrive at the surface in the core barrel, in a new method of preserving the fluid content of cores during transportation. This new technique is based on the principle of injecting humidified air under pressure into the metal transportation cylinders.

The pressurized humidified air method eliminates all doubts of causing false porosity in the cores. Tests have proven that cores transported under humidified air pressure will not gain or lose weight over a 24-hour period. The cores handled in this new manner do not pick up any water due to condensation.

Metal cylinders made of aluminum are used as a housing in which to seal the cores under pressure. One end of the cylinder is made air tight when built. The other end of the cylinder is equipped with an air tight screw cap with a valve stem in the center. When the cores are taken from the core barrels on the rig floor they are placed in half cylinder trays for easy carrying to the cylinders in the laboratory truck. Trays containing the cores are placed inside the cylinders. Humidified air is forced into the cylinders through the valve in the air tight cap.

This humidified air pressure method facilitates the analysis of the cores. Under this process the cores are ready for analysis at the unscrewing of a cap. The method is also less expensive to operate because it eliminates the necessity of importing dry ice and hauling dry ice to well sites. *Rotary Engineers Laboratories.*

Check No. 10 On The Time Saver Card

●

New 350-Hp. Model Added To GX Mud Pump Line

A new 350-hp. mud pump, known as the Model GXQ, is an addition to the line of GX power mud pumps which already includes the 625-hp. Model GXP, and the 825-hp. Model GXR. Model GXQ is a 16-in. stroke pump, and is rated at 350 b.hp. at 70 r.p.m.

Model GXQ has been designed with many of the same construction features as the larger pumps. The divided fluid end construction with reversible fluid cylinders means that a single spare cylinder can be used on either the right or left side of the pump. This feature simplifies the parts-stocking problem and facilitates field repair.

A force-feed lubrication system supplies a steady flow of filtered oil to working parts in the power end. Single herringbone gears transmit power smoothly and quietly. One-piece connecting rods have no bolts to loosen or fail under high plunger loads. *Gardner-Denver Co.*

Check No. 11 On The Time Saver Card

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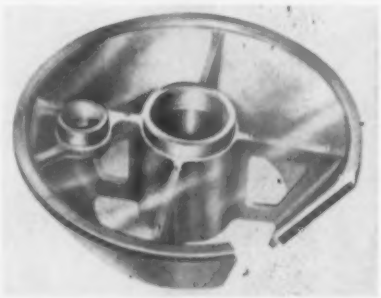
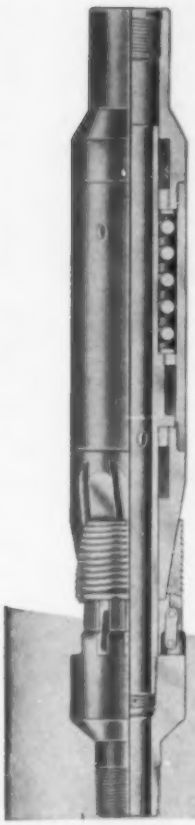


Vapor Recovery Unit Saves Loss in Tank Loading

A new vapor recovery unit for preventing loss of vapors from volatile liquids during the loading of tank cars and trucks can easily be connected to existing loading rack standpipe, or hose units.

The Greenwood vapor recovery unit consists of a conical shape, lightweight aluminum housing; a Hycar-rubber sealing ring; a transparent plexiglass cover; and connection for the vapor recovery hose. When attached to the fill pipe and placed in the loading dome, the Hycar ring provides a positive seal, thus preventing loss of vapors. A snap cover permits observation when filling. *Vernon Tool Co., Ltd.*

Check No. 12 On The Time Saver Card



NEW-

AMERICAN IRON *Hydraulic-Mechanical* PACKER HOLDDOWN, Type "HD"

Use this new, American Iron tool to hold packer in place in those applications where pressure under packer is considerably greater than pressure above.

Especially recommended for . . .

- *High Pressure Acidizing*
- *Formation Fracturing*
- *Water Flood Input Wells*

Only packer holddown on the market that can be released without first equalizing pressures above and below packer.

AMERICAN IRON & MACHINE WORKS CO. MANUFACTURERS OF OILFIELD EQUIPMENT A OKLAHOMA CITY U.S.A.

MANUFACTURERS OF DRILLING EQUIPMENT
• PRODUCTION EQUIPMENT • FISHING TOOLS • PUMP SPECIALTIES

more money in the bank . . .

YOU SAVE when you log as you drill with Geolograph because Geolograph gives the driller the information he needs to do the most efficient job! Shallow or deep . . . you get more for your drilling dollar with Geolograph on the job!

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MECHANICAL WELL LOGGING SERVICE
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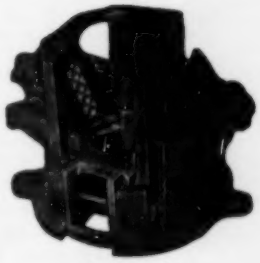
Farmington, New Mex. • Liberal, Kan. • Oklahoma City, Okla. • Bakersfield, Cal. Abilene, Houston, Odessa, Lubbock and Wichita Falls, Tex. • Shreveport, and Baton Rouge, La. • Casper, Wyo. • Glendive, Mont. • Sterling, Colo. Edmonton, Alberta, Canada



(Pat. Pend.)

Air-powered

TUBING SPIDER

(A Cavins Co. Product)

Two of the many reasons why you will be glad to own an **ADVANCE TUBING SPIDER**

1 CONSTRUCTION: Heat treated steel is used throughout. With a minimum of weight and bulk you get the greatest strength and longest wearing life.

2 LUBRICATION: All bearings and journals equipped with grease fittings. Air cylinder and foot valve are mist lubricated thru the air stream.

Bulletin TS-54 tells the whole story.
We invite you to send for your copy.

Advance Oil Tool Co.

2853 Cherry Ave., Long Beach 6, Calif., Ph. 485-64

Mid-Continent Rep: Hillman-Kelley
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There is no safer, longer lasting chain than
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When you order chain from your supply store, always specify CAMPBELL
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Makers of Famous Lug-Reinforced TIRE CHAINS

They're NEW

- Bulletins
- Catalogs
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for your copy, check ✓ ✓ the Time-Saver Cards.

Stratafrac for Increased Oil Production. This combination fracturing and acidizing service for increasing oil and gas production from sandstone, chat, conglomerate, limestone, and dolomite formations is described in a four-page, two-color brochure. A chart of field results is included. *Dowell Incorporated.*

Check No. 13 On The Time Saver Card

●

Palco Seal. Bulletin 4-02 describes the use and properties of a fibrous redwood product especially processed to prevent loss of circulation in drilling muds. In addition to description of the material, manufacturing techniques, and application information, the new bulletin contains graphs showing comparative sealing efficiency test data procurred under rigidly controlled conditions. *The Pacific Lumber Co.*

Check No. 14 On The Time Saver Card

●

Fire Clay Refractories Handbook. Designed to afford helpful information and reference material, this 126-page volume embraces all of the company's products in addition to providing tables, charts, and other valuable data for men using, installing, or specifying fire-clay refractories. The handbook is sectionalized for greater convenience and contains a section finder. *Walsh Refractories Corp.*

Check No. 15 On The Time Saver Card

●

Flex Ring Closures. Bulletin No. 3,000, perforated for binding, presents engineering details on closures that give easy access to the inside of pressure vessels or piping. The closure seals tighter and tighter as the internal pressure upon it increases. Only one bolt is required to seal or unseal the unit. *Sillers Engineering Co.*

Check No. 16 On The Time Saver Card

●

Tank Heater Bulletin. A new four-page pamphlet No. 3005 contains complete information on the product including available sizes, capacities, dimensional drawings, and illustrations. *Drayer-Hanson, Inc.*

Check No. 17 On The Time Saver Card

●

Corrosion Control of Electric Light and Power Structures and Equipment is designed to be of assistance to operating men concerned with maintenance of transmission towers and other steel structures subject to corrosive problems. *Subox, Inc.*

Check No. 18 On The Time Saver Card

●

Otis Pressure Control Service and Equipment. This 1954-55 catalog lists all the production control equipment and services offered. The catalog is indexed for easy reference use, and includes illustrations and extensive technical data on each unit. *Otis Pressure Control, Inc.*

Check No. 19 On The Time Saver Card

●

Standby Electric Plants and Controls, Technical Bulletin T-O11, covers the installation of emergency standby electric generating plants and automatic line transfer controls. The bulletin covers subjects of more or less technical nature in simple language. Descriptions of standby electric generating plants, methods of control, and easy-to-understand wiring diagrams are included in this 16-page booklet. Typical installations are pictured clearly for easy understanding. *D. W. Onan & Sons, Inc.*

Check No. 20 On The Time Saver Card

●

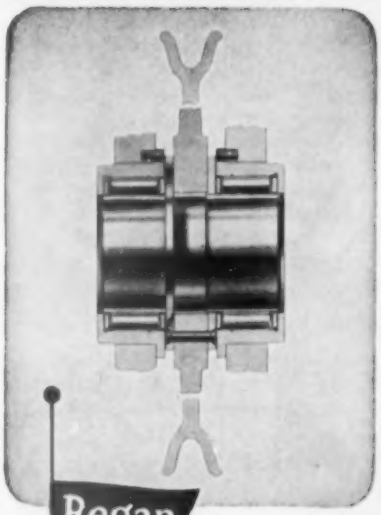
Composite Catalog No. 5001, a revised composite catalog, has added many new features. Containing brief descriptions of all Brown Instruments, the new catalog gives comprehensive coverage of the products of the Industrial Division. *Industrial Division, Minneapolis-Honeywell Regulator Co.*

Check No. 21 On The Time Saver Card

●

Oil-Field Auxiliary Power. Advantages of ownership of Caterpillar diesel electric sets for auxiliary oil-field power are outlined in an attractive two-color, eight-page booklet. The booklet presents illustrated stories of the application of Caterpillar electric sets in isolated areas where reliable power is mandatory. On the job photographs of Cat electric sets and the men who use them, and signed testimonials on reliability and efficiency of Caterpillar auxiliary power under severe operating condi-

STANDARD
OF THE
PETROLEUM INDUSTRY
Since 1905



Regan *time proven*

DUAL BEARINGS

. . . for greater bearing life and longer wire line life. With Regan exclusive, rotating inner race Dual Bearings, each sheave has an integral rotating pin which distributes bearing wear around the entire area of the pin. Bearings on *each side* of the rotating pin prevent oscillation of the sheave. This construction permits use of smaller bearings which enables the block to operate at greater speed with less friction and minimum wire line slippage. Exclusive Regan long-lived Dual Bearings are embodied in all Regan Crown and Traveling Blocks.

Write for detailed information.

50

Regan

Forge & Engineering Co.

Quality – Wrought on the Forge of Experience

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Exclusive Mid-Continent and Export Distributor:
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tions, are presented. *Caterpillar Tractor Co.*

Check No. 22 On The Time Saver Card

●

Pipeline Progress, a new, colorfully illustrated brochure, describes 45 years of pipeline installation work. The brochure contains photographs showing actual pipeline installations for many and varied projects in all parts of the country. The text tells how the company, from a small beginning in 1905 in the residential plumbing field, has now progressed to the point where they employ 200 people and are exclusively engaged in laying pipelines. *C. N. Flagg Co., Inc.*

Check No. 23 On The Time Saver Card

●

Corrosion Resisting Coating, Lining, and Surfacing Materials. This Bulletin No. 100 places corrosive service conditions in broad classifications, defines Carboline products in general terms, and estimates the life of the product in each corrosive condition, or states flatly "Not Recommended." The bulletin is a reference data sheet for the specification or maintenance engineers. The practical limitations of each material are made clear by tabulated data. The value of the tabulation is enhanced by the fact that Carboline products include phenolics, furans, neoprenes, vinyls, rubber base resins, and epoxies. *Carboline Co.*

Check No. 24 On The Time Saver Card

●

V-Corr. A new eight-page brochure describes the use of V-Corr, an enamel-on-steel roofing and siding material. V-Corr is made from a corrugated steel base to which porcelain enamel has been fused at 1,550° F. It offers complete protection against fire, corrosive gases, moisture, steam, smoke, and salt air. The illustrated brochure describes the advantages, composition, colors, and methods of installing. *Toledo Porcelain Enamel Products Co.*

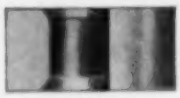
Check No. 25 On The Time Saver Card

●

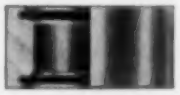
Alloy Steels Pay Off shows some of the changes in economic factors that have made alloy steels, as a class, increasingly more price-worthy. It presents some actual case histories where the adoption of alloy steel has saved money for the producer of the finished parts, or the user, or both. The book indicates the general benefits, which may include greater pay load, lower operating costs, longer life, greater safety, and less maintenance. *Climax Molybdenum Co.*

Check No. 26 On The Time Saver Card

Ball and Seat ASSEMBLIES



"Single Seal" Seat
A competitively priced stainless steel seat for routine pumping.



"Double Seal" Seat
For harder than usual pumping—double contact with the ball.

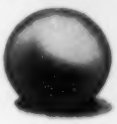
"O-Ring" Seat
Recommended particularly where ordinary or fracturing sand is causing seat failures. A 2-piece seat made of stainless steel.

"Sheralloy" Seat
A cast alloy definitely proven resistant to corrosion. Also good for hard pumping.

"Stainless Steel" Ball
For ordinary pumping where little trouble is encountered.

"Ceramic" Ball
Nearly as hard as a diamond. Non-corrosive and non-magnetic.

"Monel or Hastelloy D" Ball
Both are non-magnetic and quite resistant to corrosion but are softer than stainless steel balls. Monel is cheaper.



"Sheralloy" Ball
Excellent to combat corrosion and hard enough for deep pumping. Non-magnetic.

What is your trouble?

CORROSION?
Deep Pumping — Use a Baird "Sheralloy" seat with a "Ceramic" ball.
Shallow Pumping — Use a Baird "Stellite" seat with a "Monel or Hastelloy D" ball.

BALL PITTING?
Use a Baird "Double Seal Stainless" seat with a "Ceramic" ball.

FRACTURING or FLOATING SAND?
Use a Baird "O-Ring" seat with a Stainless ball.

BAIRD Products are available only through supply stores and pump shops.

BAIRD MFG. CO.
P. O. Box 380 TULSA, OKLA.

EQUIPMENT MEN . . . in the News

Lunkenheimer Announces Top Sales Appointments

H. A. BURDORF

Melvin W. Pauly has been named general manager of sales, and Harold H. Layritz assistant general manager of sales for The Lunkenheimer Co., Cincinnati, according to Harry A. Burdorf, vice president in charge of sales. Pauly joined the company in 1950 as New York manager, and later became sales manager, eastern division.

Layritz was previously sales manager of the central division. He is a 27-year veteran with the long established valve manufacturer.

M. W. PAULY

H. H. LAYRITZ

Burdorf, well known in industry, started with Lunkenheimer in 1905 as draftsman in the tool design department. He was later transferred to sales, where he served for many years, becoming sales manager in 1922, and vice president in charge of sales in 1940.

Day Appointed Engineer For Lane-Wells Branch

Lynn W. Day, well known in the Rocky Mountain oil area, has been appointed district packer service engineer for Lane-Wells Newcastle, Wyo., branch.

Day has been with Lane-Wells since 1948, and knows the problems of the Rocky Mountain fields through service as perforating operator, working out of Casper since 1951.

Texas Iron Adds Rogers to Sales

William O. Rogers has been added to the sales staff of Texas Iron Works, Inc., Houston, according to Edwin Goodwin, sales manager. Rogers will serve in the West Texas-New Mexico area, as sales engineer and headquarter in Odessa, Tex. Rogers was formerly with Ridman Supply Co.

Harry H. Halsell is district manager of the Permian basin area.

Sage Added to Lincoln Executive Staff

Robert E. Sage has been made assistant to executive vice president, J. S. Roscoe, for The Lincoln Electric Co., Cleveland. Roscoe is in charge of business administration and sales for Lincoln. Sage will act as an administrative assistant for sales.

Sage has been in the Lincoln sales organization for 6 years as a rural dealer manager and has been, for the past year, in charge of dealer training at the Lincoln plant. He has organized and conducted the training course for dealers which is given every month.

Phillips to Represent Hamer in Alberta

Fred W. Phillips Supply & Manufacturing Co., Calgary, Alta., Canada has been appointed as exclusive sales agent for Hamer line blind valves and Hamer Non-Stick plug valves in the province of Alberta. In making the announcement, Leland Hamer, president of Hamer Oil Tool Co., pointed out that the addition of Phillips is a part of a program to better serve Canadian companies that use Hamer valves.

Fred W. Phillips and Leland Hamer at Hamer's Long Beach plant.

Other companies representing Hamer in Canada are Preston Phipps, Inc., Montreal; Noll Moffitt, Ltd., Toronto; and P. D. McLaren & Son, Ltd., Vancouver.

American Car & Foundry Purchases W-K-M Co.

Officials of American Car & Foundry Co. have announced that A.C.F. has contracted to purchase W-K-M Co., Houston. One of the leading manufacturers of high-pressure steel valves for

Foreign Delegates Attend John Zink Seminar

The fourth annual John Zink Process Heating Seminar, held April 27 in Tulsa, was attended by a number of foreign delegates. Front row: A. N. Ramachandan, India; Miguel Paz, Colombia; Sia Honari, Iran; Hossain Monsaulan, Iran; D. W. Gard, Canada; Robert W. Reed, chief engineer, John Zink. Back row: Chieh Chu, Formosa; A. Ebrahimi, Iran; Joe Sherat, Iran; Jay Nouri, Iran; J. Holger Hansen, Denmark.

EXTRAORDINARY OPPORTUNITY
for
TOP-FLIGHT OIL EXECUTIVE

A large independent oil and gas organization, with Dallas headquarters, is seeking an experienced and seasoned man for an executive position. This man should be widely acquainted in the petroleum industry and must have thorough knowledge of Southwest and particularly Texas major companies and large independents. He should have at his fingertips the proper contacts for any type of deal or negotiation.

The man being sought should be able to make quick contact with principals of major companies or independents on such an intimate basis that he has immediate entree at all times. He should be so well grounded in petroleum industry affairs that he has the ability to negotiate any type of deal, whether it be the purchase of producing properties, leasing, farmouts, a good exploration deal or whatever type of negotiation is at hand.

All information submitted will remain confidential. Applicants and their backgrounds will be thoroughly screened. Compensation of applicant will include the opportunity of sharing in profits of this prominent independent company. Send complete information about oil industry background and experience to Box No. H-194, The Oil and Gas Journal.

oil-field and pipeline equipment, W-K-M was founded in 1919 and has grown with Texas oil industry.

W-K-M, with a sales office in Los Angeles and an export office in New York, will operate as a wholly owned subsidiary of American Car & Foundry, and will continue in Houston, where its plant covers an area of six city blocks. Local management and personnel of W-K-M will continue as in the past.

Shugart Elected President Research, Inc.

Thomas R. Shugart has been elected president of Research, Inc., Dallas. He was formerly a geophysical consultant. Previous to that he had been president of Texana Exploration Co. and an executive of Geotechnical Corp. The principal activity of the company is research and development in the field of mineral exploration, conducting geophysical and geochemical surveys, and the development of special geophysical instruments.

Security's new building at Casper.

Security Expands Casper, Duncan Facilities

Security Engineering Division, Dresser Operations, Inc., has announced the expansion of sales and service facilities in its Rocky Mountain Division and Duncan, Okla., district offices.

In the Rocky Mountain area, Security has acquired a newly constructed building in Casper, Wyo. The new structure will house the division personnel as well as provide increased warehouse facilities. Roland O. Crawford is Security's Rocky Mountain division manager, while Bud Penniston, Rex Durham, R. S. Johnson, and Joe Abrams handle sales and service.

A similar move to a new building by the Duncan office of Security has also been made. Warehouse facilities have been increased to provide faster service in that area. The Duncan office is under the supervision of District Manager Floyd Huston, while Gene Martin and Gilbert Charleston are the Security sales engineers for this area.

Hill, Hubbell & Co. Move Young to New Position

R. J. YOUNG

Robert J. Young has been appointed assistant division manager of Hill, Hubbell & Co., division of General Paint Corp., Cleveland, according to a recent announcement by M. M. Bowen, vice president.

Young has been a member of Hill-Hubbell's Cleveland staff since 1937. After having completed plant and office experience, he held positions of increasing responsibility within the company. Until his most recent appointment, Young has been district manager, East Coast territory at Ridgewood, N. J.

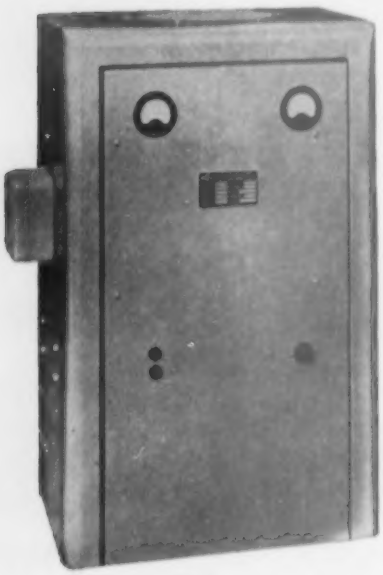
Philips Opens Office For Houston Area

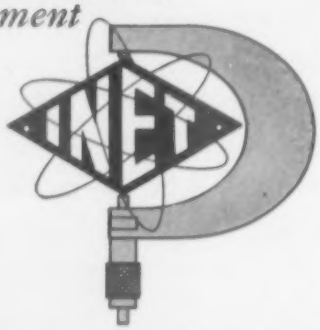
The Research & Control Instrument Division, North American Philips Co., Inc., Mount Vernon, N. Y., has announced the opening of a new regional office at Houston.

Robert Seibert is manager of the new headquarters which will serve Texas, Louisiana, Mississippi, and Florida.

Equipment displayed and demonstrated in the Houston office will include the complete line of Norelco X-ray diffraction and spectrographic instruments and accessories, also industrial radiographic units. Spare parts and service will be available also.

Precision DC Power Supply
for Electronic Equipment





◆ Efficient, closely regulated selenium rectifiers for all types of computers, business machines and other electronic equipment.

Low initial cost . . . low maintenance, units have no moving parts or vacuum tubes.

Compact, completely self-contained, protected . . . magnetic amplifier controls . . . fully regulated DC power supply.

Optional steel cabinets for floor-standing, wall or caster-mounted.

Output ratings from 5 to 500 VDC at 5 to 200 Amps continuous.

Complete engineering specifications available upon request.

INET
DIVISION OF LEACH CORPORATION
4441 Santa Fe Ave., Los Angeles 58, Calif.
Telephone LOgan 8-4771

The new pipe line of the Northern Natural Gas Co., consisting of 70.8 miles of 30" pipe, extends the firm's natural gas service into central Iowa.

New lightweight, reinforced TRANSHIELD ASBESTOS PIPE LINE FELT

Permits high speed wrapping . . . assures effective protection for enamels

TRANSHIELD now offers pipe line men the fine protective qualities of an asbestos shield at a lower price . . . with the added advantage of improved application characteristics. Transhield is a quality felt . . . assuring long trouble-free service. It is designed to meet all ordinary wrapping needs.

Transhield provides a continuous asbestos membrane, protecting and preserving the enamel coating. Highly resistant to soil stress, it is particularly suitable for use where pipe must be laid in heavy clay soils. It cannot rot or decay . . . presents an almost indestructible barrier against soil chemicals.

Contractors like Transhield because its special reinforcement makes it easy to apply, even at high speeds. Embedded continuous glass yarns parallel-spaced on ¼" centers give Transhield unequaled tear resistance. Transhield's light weight permits furnishing it in 800-ft. rolls. This advantage cuts roll changes in half for field wrapping equipment.

Johns-Manville has developed three wrapping materials for pipe line protection:

J-M 15-lb. Asbestos Pipe Line Felt (perforated or unperforated)—for severe soil conditions.

J-M Transhield Asbestos Pipe Line Felt—for average soil conditions.

J-M Trantex® polyvinyl pressure-sensitive tape—for pipe line corrosion protection where ease of application is important . . . as a coating over field-welded joints of mill-wrapped pipe . . . for rush coating needs such as when making emergency pipe line repairs.

For further information write Oil Industry Department, Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ont.

Johns-Manville ASBESTOS PIPE LINE FELT

LEADING PORTABLE DRILLING RIGS

AND DIAMOND ROLLER CHAINS

THEY GO TOGETHER

Every Link Carries the Diamond

As for all oil country machinery and equipment, *dependability* of performance out on the job is the number one requirement.

All details and all components of the rigs are meticulously selected and engineered to provide long-life, continuous service. It is but natural that the Roller Chains with long years of proven high quality, great reserve strength and reliability are regular equipment on America's finest portable rigs—Diamond Roller Chains.

DIAMOND CHAIN COMPANY, Inc.

Where High Quality is Traditional

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Tulsa Office: 2238 Terwilleger Blvd.

Offices and Distributors in All Principal Cities

Please refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

DIAMOND ROLLER CHAINS

EXPLORATION

Another Look at Washington

by John C. McCaslin

LET'S take another look at the oil and gas possibilities of the State of Washington. After a 2½-year lull in exploratory developments in the Pacific Northwest, reports show that four wildcats are under way in the state, once again reviving interest in this geologically complicated area.

New test . . . The most important new test in the state was recently spudded by Continental Oil Co. in Grays Harbor County. The wildcat is designated as the 1 Fee-Simms, SW SW 31-19n-8w (D on map). It is located on the Wishkah structure about 25 miles northeast of the area where Union Oil Co. of California and others found shows of oil and gas in 1951.

Continental's new test is expected to be the first of several slated for its substantial holdings in Washington. These reportedly are being evaluated further by core drilling.

Current activity in the state consists of three cable-tool tests. Harbor Oil Co. is drilling below 850 ft. at 1 Halvarsen in 27-14n-10w, Pacific County (F on map). Also in Pacific County, Long Beach Oil Co. 2 Long Beach, 8-10n-11w, is drilling at about 100 ft. Another wildcat is idle at 450 ft. in the area. It is Seattle-Toledo Co. 1 Hoskins in Lewis County (E on map).

Gray Harbor History

Although six deep tests have been failures, the Grays Harbor area has long been recognized as potential oil country. Union Oil Co. has produced small quantities of high-gravity oil and gas, but the tests were given up because of sloughing shales.

In 1951 a wildcat in the coastal area at Grays Harbor caused a revival of interest in the potentialities of the area. It was Hawksworth et al. 4 State, drilled to a total depth of 3,711 ft. Three high-pressure gas sands were penetrated in the 126 ft. of hole cut after topping the Miocene-Kincaid zone at 3,585 ft. On an 8½-hour test through a small tubing choke the well flowed gas at rates of 500 to 2,000 M.c.f. per day with a potential recovery of 47°-gravity oil estimated at 35 to 100 bbl. daily.

The Hawksworth well was drilled below mean high-tide line in 15-18n-12w. It was drilled in an area where seismograph and subsurface studies conducted by Union indicated the apex of a large structure.

Current and previous exploratory tests in western Washington are indicated by letter and are keyed to the text. The state has two economically unimportant gas fields.

Washington Geology

The state is divided into two major provinces by the Cascade Range, east and west. Most of eastern Washington is occupied by the Columbia River Plateau, an immense lava-underlain area. Major features of western Washington include the Willapa Hills in the south and the Olympic Mountains in the north, separated by the Chehalis River syncline. Along the west front of the Cascades the Puget Sound-Cowlitz depression trends north-south. Tertiary rocks of both sedimentary and igneous origin occupy the basin area, the Willapa Hills and the edge of the Olympic Mountains. Miocene and Pliocene formations are for the most part restricted to the Grays Harbor area.

Most of the Grays Harbor area is considered favorable for the accumulation of petroleum. The state's thickest deposits of Pliocene and Miocene sediments are located in the county. Beds exposed in this deep basin are upper Miocene in age with exposures of Oligocene and Eocene coming in to the north, east, and south as the beds climb toward the Olympics, Cascades, and Willapa Hills.

There is no commercial oil or gas production at present in Washington. The state has two gas fields, neither of which is economically important. Bellingham gas field (A on map) in Whatcom County is a shallow pool in the Bellingham basin area. The gas produced in the field is largely methane. It occurs in lenticular Pleistocene sands on the north flank of the King Mountain anticline.

Benton gas field in eastern Washington's Benton County is the most important indication of oil or gas in this section of the state. The gas wells are located near the crest of an anticline. Surface rocks in the area consist of stratified tuffs, ash beds, and breccias interlaminated with basaltic lava flows. The gas in the field is produced from porous lava at depths of 750-780 ft. and is 84 per cent methane and ethane. The gas source beds are assumed to be lava-buried swamp deposits.

About 275 wells have been drilled in Washington, a large number of them put down near surface seepages. A great many wells have been drilled without geological data. Some of the deeper wells in the state were put down with geological or geophysical data, and deep tests furnished important stratigraphic information. The state's deepest hole is located between Seattle and Everett (B on map) at Standard 1 Alderwood. The test was abandoned at a depth of 11,002 ft. in Eocene-Crescent shales.

Why Not Washington?

The new interest in the Pacific Northwest's oil and gas possibilities is another step toward exploring heretofore nonproducing areas. Just this year one new state has been added to the country's production list and two more have prospects. South Dakota got into the column earlier in the year. At the same time a wildcat in Nevada showed for possible production. A Shell Oil Co. test in Arizona, although a failure, recovered gas on tests, promising that that state has not been crossed off the list. The new drilling in Washington may well promise big news in the future for the Pacific Northwest.

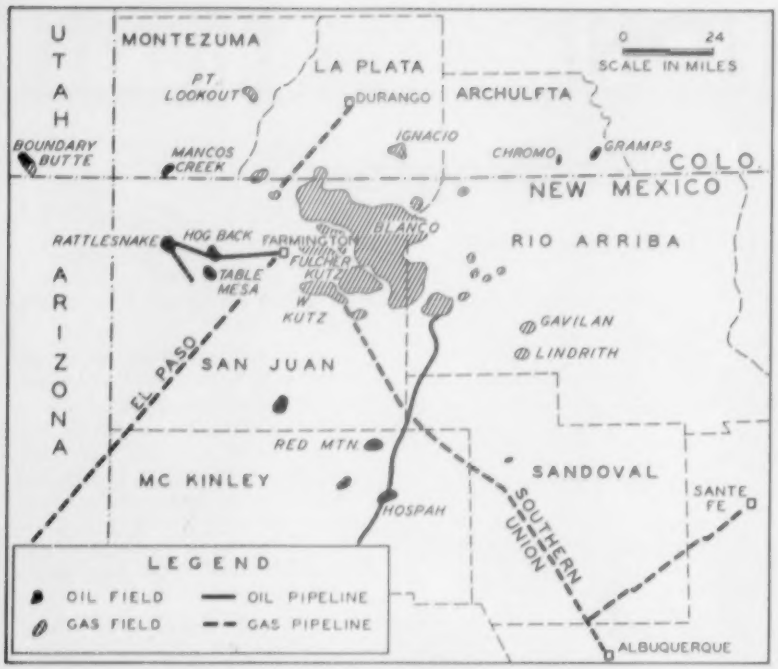

Fig. 1—Current gas production from the San Juan basin is 375 M.M.c.f. daily. During 1953 there were 15 successful wildcats out of 41 holes drilled with 13 gas wells and 2 oil wells.

San Juan Basin Activity Spurred By Prospect of Gas Pipeline

by Norman S. Morrisey

THE Pacific Northwest Pipeline Co. efforts to build a gas line are another stimulus for the San Juan basin of Northwest New Mexico.

At the present time there are 6 wildcats drilling and 58 active field wells, with the majority of the activity centered in the gas fields of San Juan County, New Mexico. Development drilling in the basin constitutes about 20 per cent of the total activity in the Rocky Mountains. Most of the production in the area is gas with only minor amounts of oil.

During 1953, northwestern New Mexico had 15 discoveries from 41 wildcats; only 2 of the discoveries were oil, the rest gas. There were 585 field wells drilled, with 549 gas wells, 8 oil wells, and 28 dry holes. Best exploration results during 1953 occurred along the east side of Blanco field in Rio Arriba County, New Mexico (Fig. 1).

Reserve estimates for the basin exceed 15 trillion cubic feet; present daily production is 375 M.M.c.f. Mesaverde sands at the Blanco field account for 275 M.M.c.f. per day.

Final decision on the proposed pipeline is still pending. However, it puts northwestern New Mexico in a very favorable position for a larger future market for its gas reserves. The line will be capable of handling 245 M.M.c.f. per day and eventually will carry 350 M.M.c.f. Present outlet for San Juan basin gas is California, via El Paso Natural Gas Co.'s pipeline.

Regional structure . . . San Juan basin is the principal structural feature of northwestern New Mexico; it extends into southwestern Colorado. The basin is encircled by uplifts that have been positive areas from pre-Cambrian until late in geologic time.

The Laramide orogeny affected most of the basin, rejuvenating many of the ancient uplifts. Most of the anticlines that are now productive were formed at that time.

Producing Zones

Upper Cretaceous sands are the principal gas-producing zones (Fig. 2). Accumulation is controlled by structure and updip pinchout of the producing zones and depth to the producing zone varies from 2,000 to below 8,000 ft.

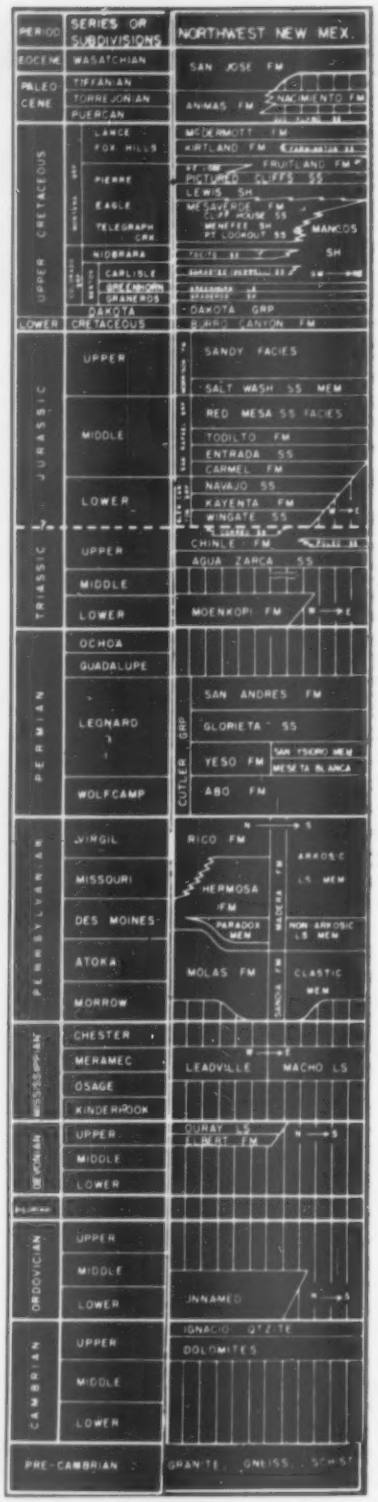

Fig. 2—Simplified stratigraphic chart of the San Juan basin (after Glambattista). Upper Cretaceous sands and the Paradox limestone account for most of the gas and oil production in the San Juan basin. Mesaverde production accounts for two-thirds of the present daily production.

Fruitland . . . The Fruitland zone produces at Ignacio gas field in southwestern Colorado. This zone consists of 200 to 300 ft. of dark-gray to black shales and gray fine-grained carbonaceous sandstones. It contains thin coal beds and is probably of continental origin.

Pictured Cliffs sandstone . . . One of the important gas reservoirs of the San Juan basin is the Pictured Cliffs sandstone; it produces at Aztec, West Kutz, Blanco, Kutz Canyon, and Ignacio fields. At Ignacio it is about 300 ft. thick and is a gray, fine-to-medium-grained sandstone with shale and coal partings in its upper part.

The Pictured Cliffs and Fruitland in Colorado are produced as one zone.

Mesaverde . . . The Mesaverde produces at Blanco field. It is divided into three members from top to bottom, the Cliff House, the Menefee, and the Point Lookout.

Original Mesaverde reserve estimates for the Blanco area were about 4 trillion cubic feet. Developments in the past 3 years indicate reserves may exceed 10 trillion cubic feet. About 70 per cent of these reserves in place will be produced.

The Cliff House is a gas sand and consists of massive marine sandstones, 135 to 240 ft. thick in the Blanco field. These sands are fine to medium grained. Although abrupt changes in lithology are common, average pay thickness is 58 ft.

The Menefee section is not important economically and is a continental deposit of lenticular shale and coal beds with thin sandstones. Its thickness ranges from 360 to 420 ft.

Thick massive sandstones of the Point Lookout form the basal formation of the Mesaverde group. Thin shale and sandy shale separate these sands. The Point Lookout is probably marine in origin and is 130 to 190 ft. thick in the Blanco field. Porosity and permeability vary laterally with an average pay thickness of 61 ft.

Production at Blanco field is controlled by stratigraphy rather than structure. Recent discoveries in 1953 along the east side of the Blanco area have increased reserves considerably.

Tocito . . . An important future reservoir in the San Juan basin is the Tocito sandstone. It produces oil at Doswell and gas at Pettigrew. At Doswell it has a net pay thickness of 20 ft.; the porosity is 15.1 per cent and permeability averages 138 md.

Dakota . . . The Dakota sandstone covers a potential producing area of 15,000 sq. miles and produces from both anticlines and stratigraphic traps. The major anticlines such as Rattlesnake, Barker Dome, Hogback, and Hospah have less than 500 ft. of closure.

Low-relief seismic structures with less than 100 ft. of closure are the best bet for future Dakota production.

The lithology of the Dakota is highly variable and consists of lenticular sandstone interbedded with shales and coal lenses. Coal is more common in the middle of the Dakota section.

Correlations can be made over distances of 50 miles in spite of the lenticular nature of the sands. Although the individual sands are not continuous, the over-all thickness is relatively uniform.

Since the Dakota was deposited during a transgressive sea, sand pinchouts are common.

Wedging out of the producing sand updip is responsible for the Dakota production at Lindrith and Doswell. Most of the Dakota production to date, however, is from anticlines, such as Barker Dome, Hogback, and Rattlesnake.

Additional well control will help in locating sand pinchouts within the Dakota.

Paradox . . . Porous limestones in the Paradox are the lowest important producing zone in the San Juan basin. Barker Creek is the principal Paradox

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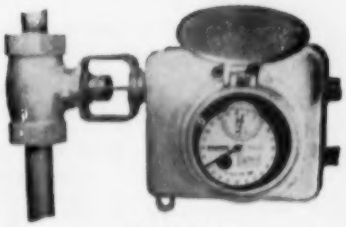

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gas reservoir with reserves in place of about 2 trillion cubic feet. Total effective pay thickness is 270 ft. from the three principal producing zones and estimates indicate reserves of about 51 M.M.c.f. per acre. Production comes from three zones within the Paradox and locally from a fourth zone. Porosities range from 1.5 to 3.5 per cent and permeabilities from 0.1 to 30 md. Although both primary and secondary porosity occur in the Paradox, some of the gas production is from fractured reservoirs.

Drilling Practices

Customary practice in the San Juan basin is to drill to the top of the Cretaceous pay sands, using rotary tools. Casing is run and then the pay section is drilled in with either a rotary rig or a modified cable-tool outfit using a rotary setup. Natural gas is used as the drilling medium to drill through the pay sands. Water-base muds cause the bentonite in the Cretaceous sands to swell, sealing off the producing zones. The pay section is shot using large quantities of nitroglycerin. Recently several wells have been fractured but no data are available to determine if this method is successful.

Drilling problems . . . Principal problem in the San Juan basin is lost circulation and mud costs of many wells have exceeded $10 per foot. Cottonseed hulls and fibers are used to combat this problem and granular inert solids are also successful in controlling mud loss.

Outlook . . . Exploration and drilling activity in the San Juan basin will continue at a high rate for the rest of 1954. A ready market for the tremendous gas reserves is assured, especially with the prospect of a pipeline to the Pacific Northwest.

Best prospects for future production lie in the stratigraphic traps and low-relief seismic structures and in extending present fields. Deeper production is expected from Paleozoic limestones and sandstones.

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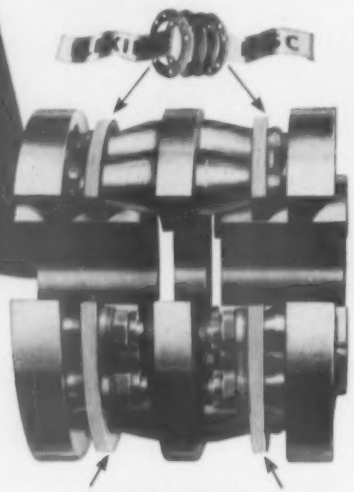

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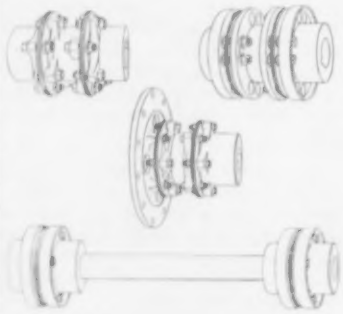

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OKLAHOMA

Keyes East Flank Has Good Development Play

The Oklahoma Panhandle's Keyes area is enjoying a rapid development program.

The area is the largest Pennsylvanian field in the four-state area. The east flank of the field recently and currently has had some good new gas wells completed in the Keyes sand (basal Morrow). The extended drilling possibly may link the Eva field 5 miles to the southeast with the huge Keyes district.

Oil production was recently opened in the area at Cities Service Oil Co. 1-A Turner, NE NE SW 24-5n-9eCM, Cimarron County. The well was finaled flowing 205 bbl. of oil plus 1,201 M.c.f. of gas per day from perforations at 4,266-96 ft. The production was confirmed and extended at 1 State-Williams Unit by Cabot Carbon Co. This well pumped and flowed 210 bbl. of 39.5°-gravity oil per day from lower Purdy sand perforations at 4,271-77 ft.

Stanolind Oil & Gas Co. 1 Ferguson, SE SE NW 2-4n-9eCM, is a new gas well. It had a calculated open flow of 62,300 M.c.f. of gas per day. Shutin pressure was 835 psi. Shell Oil Co. 1 Sparkman, NE NE SW 7-5n-10eCM, is awaiting its potential after preliminary flow of 2,500 M.c.f. per day was reported.

Two Strikes Made North Of Hewitt Production

Fain-Porter Drilling Co. is testing 1 Isbell, SE SE SW 2-5s-1w, Carter County, an indicated discovery 1 mile north of Hewitt field production.

Pay is indicated in several sections. Fain-Porter is rigging up at 1 Watson, NE NE NE 11, a ½-mile southeast stepout to the discovery.

C. W. Van Eaton is completed 1 Winters, SW SE SE 12, southeast of the 1 Isbell. The wildcat was swabbed for 10 bbl. of oil per hour after fracture treatment.

Beaver Strike Tests

The Texas Co. 1-A Barby, NW NW 2-4n-25eCM, 10 miles northeast of Beaver City

and 4 miles southwest of Northwest Knowles field in Beaver County, Oklahoma Panhandle, is an assured gas discovery.

The well flowed 3,500 M.c.f. of gas per day from Morrow perforations at 6,776-86 ft. following acidization. Testing continues.

Southeast Camrick Extension on Potential

United Producing Co. 1 Loren Sillars, NW SE 36-2n-19eCM, a 3-mile northeast extension to Southeast Camrick field in Texas County, Oklahoma Panhandle, was taking potential after flowing an estimated 25,000 M.c.f. of gas per day on last company test from perforations in the Morrow at 6,752-72 ft.

The 1 Harrison has spudded, 1 mile north of the new field extension. It is located in NW SE 25-2n-19eCM.

Final Gage at Camrick Well in Texas County

American Gas Production Co. 1 Silsbee "A," SW SW NE 21-1n-19eCM, Southeast Camrick field well in Texas County, has had its final gage.

The 1½-mile northewst extension flowed 26,600 M.c.f. of gas per day through open tubing from the Morrow sand at 6,674-86 ft.

APPALACHIAN AREA

OHIO

Indications of a new pool in Bethlehem Township, Coshocton County, was found by National Gas Co. by a small well on 1 James Waring, 2nd Qr. Clinton sand at 3,470-3,520 ft. showed 1 bbl. natural and 30 bbl. with 200,000 cu. ft. gas after fracturing.

A ¼-mile stepout to the production in southeast Fallsburg Township, Licking County, was brought in by Ulmer & Sons on the 17 Dwight Moran, Section 22. Clinton at 3,018-67 ft. made 100 bbl. in 24 hours after fracturing.

In the east end of Mount Zion pool, Mid East Oil Co. 7 Margaret Melick, Section 23, Jackson Township, Knox County, made 300,000 cu. ft. of gas and 300 ft. of oil natural, and 350 bbl. in 24 hours after a fracture treatment.

PENNSYLVANIA

In Derry Township, Westmoreland County, southwest Pennsylvania, Mid East Oil Co., is moving in a rotary rig at a wildcat location, 1 Frank Litvik, Latrobe Quadrange, .45 mile south of latitude 40 degrees 25 minutes and 4.06 miles west of longitude 79 degrees 15 minutes. Connellsville Township, Fayette County, Peoples Natural Gas Co. 1-4030 F. K. Buttermore heirs, is drilling at 6,229 ft. Cherry Hill Township, Indiana County, Chestnut Ridge Oil & Gas Co. 3 Ralph White, is at 3,840 ft.

In Cherry Hill Township, Indiana County, Mid-East Oil Co. 3 Ralph White, had a show of gas at 2,825 ft. and is drilling at 2,840 ft. This is a correction on former listing of this well.

WEST VIRGINIA

Roaring Creek district, Randolph County, West Virginia, Noilca Oil & Gas Corp. 4 Goff-Arnold Land Co., wildcat, elevation 2,604 ft., resulted in 1,566,000 cu. ft., gas, Fifth sand, 2,243-2,295 ft., gas 2,256-2,295 ft., TD 2,299 ft. In Middle Fork district, Bobray Exploration Co. 1 Chester C. Housh, elevation 2,407 ft., gaged 25,000 cu. ft., gas, Bayard sand 1,488-1,505 ft., gas 1,494 ft., TD 1,600 ft.

ILLINOIS

In Christian County about 8 miles northwest of Taylorville Arnold Valter 1 Simpson Driskell flowed clean oil in 60 minutes on drill-stem test in the Siluran lime at 1,660-69 ft. The prospective new field-opener is located on the northern edge of the Illinois basin.

In Clay County 3 miles due east of Sailor Springs, Don Slape-M. W. McConnell and R. W. Harper 1 Frank West et al, SW NW SE 22-4s-8e, 12 miles from production, got 2,100 ft. of clean oil on a drill-stem test in the McClosky lime.

ARKANSAS

Major Oil Extension Highlights April

Benedum-Trees Oil Co. completed 1 Caldwell & Lowe, C SW SW 3-20s-26w, Lafayette County, in April to extend that county's Kiblah field 2½ miles east-northeast out of Miller County. The well flowed at the rate of 192 bbl. per day, 47° gravity on 36-in. choke. Production is from perforations at 6,006-14 and 6,020-30 ft. in the Mitchell sand of the Gloyd zone Rodessa. Gas-oil ratio is 800:1.

Marginal gas wells were completed in rank wildcat areas of northwestern Arkansas in the McAlester basin. Western Natural Gas Co. 1 Roy Gray, SW NE 25-8n-24w, Logan

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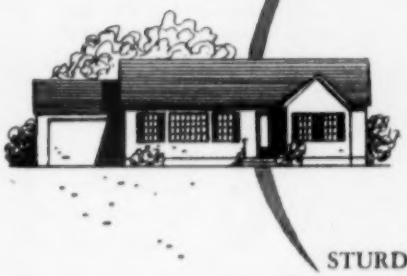

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County, calculated 88,000 cu. ft. of gas per day from open hole at 1,370-1,402 ft. The wildcat is 1 mile southeast of Prairieview.

In Sebastian County, 6 miles east of Greenwood, the 1 Bergkamp, 1-7n-30w, was finaled from perforations at 5,920-41 and 5,986-6,012 ft. for a calculated 196,000 cu. ft. of dry gas per day.

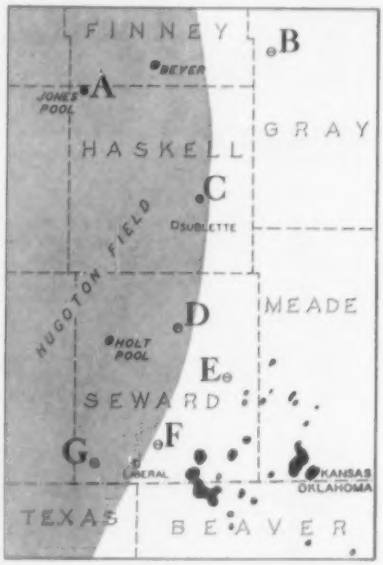
Lawton Oil Corp. and Lion Oil Co. opened a new Pettit pay in Schuler field and a new stray sand pay in the Cotton Valley, respectively.

KANSAS

Deep Hugoton Drilling On Increase in Kansas

Deep drilling in the Hugoton gas field area of southwestern Kansas is on the increase following recent Pennsylvanian and Mississippian discoveries in that area.

The latest success in the Hugoton embayment is H. C. Bennett and C. L. Roberts 1 Boatright (C on map), rank wildcat about



5 miles northeast of Sublette in Haskell County on the east flank of Hugoton Permian gas production. Lansing oil shows were logged at the wildcat and the operators are drilling ahead below 4,955 ft.

The indicated oil discovery, the second for the county, is 21 miles southeast of Helmerich & Payne 1 Jones which is on pump after swabbing 11 bbl. of oil per hour to establish first oil production in the county (A on map).

Four deep efforts have been reported in Seward County. Panhandle Eastern Pipeline Co. is waiting on cement at 1 Boles, C N½ NE 4-35s-34w, deep well in Hugoton field about 4 miles west of Liberal (C on map). The wildcat is a rework from Permian gas well. Rotary tools are going up at GMR Oil Co. 1 Atwell, 6,000-ft. test in NW NW SE 9-33s-31w, 1½ miles west of Northwest Kismet pool and 1 mile south of Kismet in east-central Seward County (E on map). M. B. Armer is moving in rotary tools at 1 Warden, C NW 25-34s-33w, wildcat 2 miles east of Hugoton field and 2½ miles northeast of Liberal in the southern part of the county (F on map). Northern Natural Gas

Co. has spudded in at 1 Collingwood, another deep test in Seward in the C SW SW 4-32s-32w, about 6 miles southwest of Thirty-One pool on the east flank of Hugoton field (D on map). The test will go to about 5,000 ft.

Gray County has a scheduled Mississippian wildcat at Continental Oil Co. 1 Laird, SE NE SW 15-26s-30w, wildcat 9 miles east of Hugoton field. Gray County recently got its first oil production at Dumbo pool. The new test (B on map) is 5 miles south of Charleston, Kans.

First Topeka lime gas production was opened in Hugoton field proper this past winter at Holt pool in Seward County by Cities Service Oil Co. The well gaged 26,600 M.c.f. of gas from the lower Topeka. Nearest Topeka production is 45 miles to the west in big Greenwood field.

In Greenwood field itself Stanolind Oil & Gas Co. and J. M. Huber Corp. recently opened first oil production in the Topeka-Lansing gas field. Oil production came from the upper Morrow sand of basal Pennsylvanian age.

Oil Recovered at Sedgwick Basin Test

Kansas City lime oil shows have been logged at Midstates Oil Corp. and M. B. Armer 1 Ravenstein, NE NW NW 4-30s-6w, stepout ½ mile southeast of new Davis pool and 4 miles southwest of last year's Orsemus pool in Kingman County.

Recovery on a drill-stem test at 3,545-65 ft. in the Kansas City was 300 ft. of oil and gas-cut mud, 780 ft. of free oil. Another test at 3,506-31 ft. recovered 200 ft. of oil and gas-cut mud and 7 ft. heavily oil and gas-cut mud. A test in the Mississippian at 4,076-98 ft. recovered 140 ft. of gas-cut mud.

Harper Ranch Pool Extended in Clark

Pure Oil Co. has extended Harper Ranch pool ¾ mile east in southeastern Clark County at 1 Harper, C SW NW 2-34s-21w.

The company reported a flow of oil and 8,000-9,000 M.c.f. of gas per day from the Morrow sand.

LOUISIANA

NORTH LOUISIANA

April Discoveries

Two new discoveries and two new pay strikes were made in April along with a new extension hit in northern Louisiana areas.

Lion Oil Co. 1 Doles, C NW SW 29-21n-13w, opened Cottage Grove field in Bossier Parish. The strike was completed flowing 55 bbl. of oil daily through 21/64-in. choke from perforations in the Buckrange.

Atlantic Refining Co. completed 1 Hemler in Richland Parish as a new gas pool opener. It flowed 77 M.c.f. of gas per day from perforations in the Gas Rock at 2,462-68 ft.

Bates & Cornell completed 2 Fletcher, C NE NW SE 9-7n-4w, as a new pay discovery in Grant Parish's Aloha field. The discovery well flowed 85 bbl. of oil per day from perforations at 3,860-65 ft. in the Wilcox. Gas-oil ratio was 395:1. Gravity is 44.2°. The new pay is a shallower part of the Wilcox formation than other wells in the field.

Carter Oil Co. 1 Young, Ivan field in Bossier Parish, flowed 97 bbl. of condensate per day through 14/64-in. choke from perforations in the Davis sand at 9,056-60 ft. to become another new-pay discovery. Gas-oil ratio is 10,600:1. Gravity is 50.2°.

Union Producing Co. 1 Antrim, 2-21n-11w, Webster Parish, extended South Sarepta field production 2½ miles east-southeast. The strike was completed flowing 66 bbl. of 65.3°-gravity condensate plus 1,003 M.c.f. of gas per day through 12/64-in. choke from perforations at 9,653-60 ft. in the Davis. Gas-condensate ratio is 15,197:1.

SOUTH LOUISIANA

One-Mile Extension at Kent Bayou Completed

Production in Kent Bayou field, western Terrebonne Parish, has been extended a mile to the southwest with completion by Union Producing Co. of its 5-A Continental, in 1-18s-13e, flowing 227 bbl. of 37.1°-gravity oil daily through 7/64-in. choke from perforations at 11,131-33 ft. Flowing pressure gaged 2,200 psi., and gas-oil ratio 1,040 cu. ft. per barrel. The field was discovered in December 1950. Both Union and Superior Oil Co. have substantial holdings in the area.

Main Pass Area Wildcat Completed as Producer

California Co. has completed another offshore oil-discovery well, its 1 State Lease 1923, located near Main Pass Block 24 field, in the Gulf of Mexico off the south tip of Plaquemines Parish. On its completion gage, the well, flowing through 19/64-in. choke,

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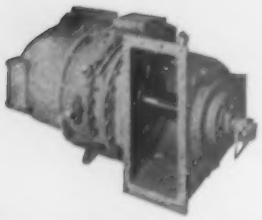
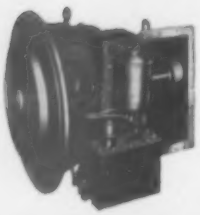
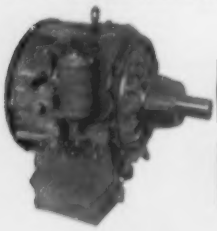


MODEL IF Twin Disc Torque Converter, independent-mounted with chain drive on input end to converter pump wheel.

MODEL F Torque Converter, flange type, bolted directly to engine flywheel.



MODEL CF Torque Converter, with Type C1 output end, has straight shaft for direct connection to driven load. Type A has narrow-chain housing; Type B has wide-chain housing; Type C2 has flanged shaft for "U" joint connection to propeller shaft.



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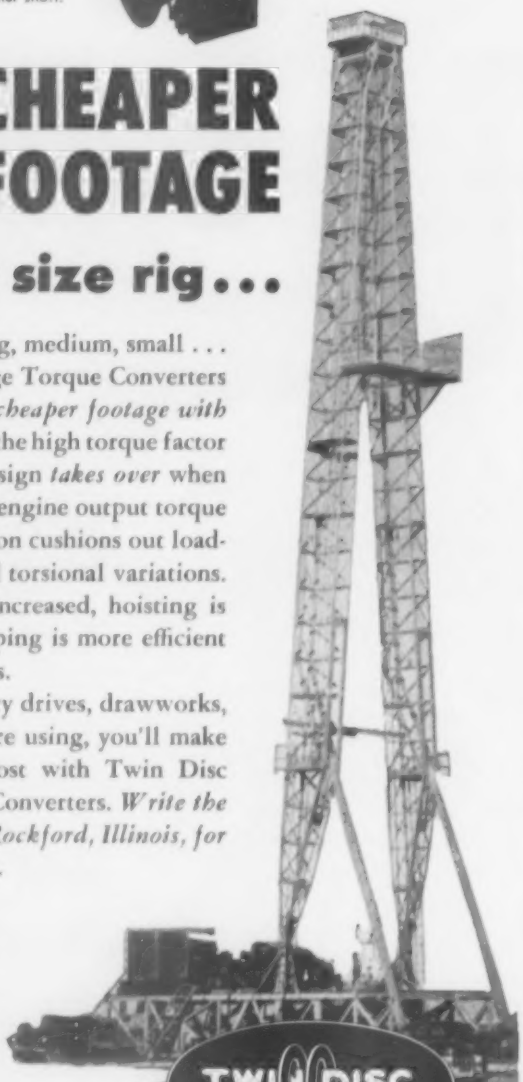

This Ideco Hydrair H-750 Rig (shown with Ideco 133' Mast) provides faster, cheaper footage through Twin Disc Torque Converters mounted behind Waukesha 6-LROU engines. Offered in 3 sizes with 7 capacities each, Twin Disc Torque Converters are provided for any gas or diesel engine rated from 40 to 750 hp.

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produced at the rate of 325 bbl. of 36.6°-gravity oil per day at 1,430-psi. pressure. Gas flow was at the rate of 485 cu. ft. per barrel of oil. Producing interval is 8,913-22 ft. in Miocene sand. Hole was drilled to 9,771 ft.

West Delta Discovery Tests Gas-Distillate

Continental Oil Co. is virtually assured of a substantial extension to its new West Delta Block 52 field, offshore from Plaquemines Parish, in West Delta area.

Its extension well, 1 State Lease 977, flowed at the rate of 1,862,000 cu. ft. of gas with 25 bbl. of distillate per day through 11/64-in. choke while testing sand interval at 7,632-42 ft. Flow was under pressure of 3,000 psi.

The well was drilled to a total depth of 11,000 ft. and has oil string cemented to 8,000 ft. with hole plugged back to 7,907 ft. The sand tested is the deepest of a series of possible productive zones to be tested before completing the well.

West Delta Block 52 field, discovered in 1953, produces oil and gas from multiple sands ranging in depth from 6,000 to 10,500 ft.

CANADA

Badger Lake Well

Another porous zone in the Madison limestone at the Badger Lake well has given up recovery of medium-gravity crude oil, backers of this wildcat announced. This well had previously yielded small gas flows in two zones of the Bow Island sand, and had also given up crude oil higher in the Madison limestone.

The well, Scurry-Anglo 1 Calvan, LSD 7, 5-17-18w4, is 25 miles southwest of Brooks, 9 miles south of the Royalite-Anglo 1 Eyremore light-gravity oil discovery well and 5 miles southwest of the H.B. 1 Eyremore abandonment.

The lower porous section of the Madison limestone was contacted at 4,250 ft., or 1,500 ft. subsea (K.B. elevation 2,750 ft.) A 1-hour drill-stem test from 4,245 to 4,265 ft. gave up 300 ft. of 26°-gravity oil, 30 ft. of oil-cut mud and 850 ft. of salt water. It is believed that the oil-water interface is near bottom of the drill-stem test, indicating some 10 to 15 ft. of zone above water.

Last week, the well entered the Madison at 3,975 ft., or 1,725 ft. subsea, and drill-stem tested from 3,975 to 3,995 ft. Recovery was 90 ft. of oil and 130 ft. of gasified oil-cut mud. Test from 3,999 to 4,011 ft. yielded only 15 ft. of oil-cut mud, no water. There were an estimated 25 ft. of porosity in this section of the Madison.

Saskatchewan . . . Another light-gravity oil discovery has been made by Canadian Gulf Oil Co. in the southeast sector of Saskatchewan, about 140 miles southeast of Regina and 85 miles southeast of Weyburn.

The discovery came at Canadian Gulf 13 Bishop, LSD 13, 11-13-1w2, which is 19 miles east-southeast of the Canadian Gulf-Canadian Devonian 9 Quinn Mission Canyon gas and oil discovery well, 20 miles east of the Cal Standard 5-21 Frobisher wildcat abandonment and 13½ miles north of the North Dakota border.

Canadian Gulf has not as yet announced results of any drill-stem testing at the Bishop discovery well, but it is learned from other reliable sources that the well gave up ap-

proximate 32 to 34°-gravity crude oil from a zone believed to be the Mission Canyon section of the Mississippian. Drill-stem tests reported gave up oil and some salt water. Has indicated approximately 15 ft. of oil pay above the water line.

The following drill-stem tests have been run. Interval 4,210-20 ft., gas in 35 minutes unmeasured, recovered 240 ft. of gassy muddy oil 20 ft. of clean oil and 10 ft. of salt water in 1 hour. Interval 4,220-30 ft., gas in 2 minutes, oil flowed after 12 stands of drill pipe had been pulled, recovered 2,940 ft. and 120 ft. of salt water in 30 minutes. Interval 4,230-40 ft., 1 hour, slight gas blow, recovered 30 ft. of oily mud, 240 ft. of clean oil and 300 ft. of salt water. Interval 4,240-50 ft., 1 hour, fair blow, recovered 60 ft. of gassy oily mud and 1,260 ft. of salt water. Interval 4,295 to 4,309 ft., recovered 3,150 ft. of oil-flecked salt water in 75 minutes.

the fourth pay zone for that field, and at the same time has indicated a possible Cambrian trend between it and the E.A.-Cambrian field.

A drill-stem test in Seaboard's well between 5,969-89 ft. had gas in 5 minutes and oil in 18 minutes. It flowed to pits to clean for 17 minutes, then tanked 23.28 bbl. of 50° oil in 1 hour through 36-in. choke. Gas-oil ratio was 523 cu. ft. Top of the Cambrian was logged at 5,969 ft., minus 3,559 ft. Prior to the above test, operators cored 15 ft. of saturated sand between 5,874-89 ft. At last report the well was drilling ahead.

Humble Oil & Refining Co. 2-NT-TXL, two locations south of production in E. A. field, flowed 84 bbl. of oil with no water in 9½ hours through ¼-in. choke, from open hole in the Cambrian at 6,065-6,169 ft. Flowing pressure was 175 psi. and gas-oil ratio was 310 cu. ft.

New operators in Cambrian play . . . British-American Oil Producing Co. has entered the Cambrian trend, in the E. A. field area, with a purchase of 160 acres from Texas Pacific Land Trust. The lease covers the southeast quarter of Section 15, Block Z, T&P Survey, which lies south of Humble's 2-NT well above, and Seaboard 5-A Hanks in Northwest Hylton field. Consideration was said to be $500 per acre, with Texas Pacific retaining ½ of the oil as royalty.

Ellenburger oil shows . . . Union Oil Co. of California 1 Young, Strawn prospect 12 miles southwest of Sweetwater, reported good shows of oil from a second pay, the Ellenburger. A drill-stem test open 1 hour from 6,935-76 ft. developed 1,000 ft. of gas and 25 ft. of oil-cut mud. Flowing pressure was 90 psi. maximum. Previously the well recovered 2,900

TEXAS

WEST TEXAS

Deep Hole in Reeves County To Be Reentered by Gulf

Gulf Oil Corp. has announced plans to drill deeper at its 1 P. G. Northrup in Section 33, Block 50, Township 8, T&P Survey, 24 miles southeast of Pecos. Present plans call for drilling and testing to 18,600 ft. The well's old total depth of 16,696 ft. was a record for the Texas portion of the Permian basin. Geologically, the deep wildcat is in the southeastern portion of the Delaware basin.

Tippett extension finaled . . . Bankline Oil Co. and Hurt Oil Co. 1-41 Forrestal, located southeast of Tippett field, has been completed for a high flowing potential. Two sections in Wolfcamp conglomerate were perforated, the upper zone between 6,187-6,218 ft., which flowed at the rate of 1,680 bbl. of oil a day through ¾ and ½-in. top and bottom chokes. Gas-oil ratio was 920 cu. ft. and casing pressure ranged from 325-225 psi. on the 2-hour test. Potential on the lower Wolfcamp, from 6,294-6,330 ft., was 1,440 bbl. of 39° oil a day, with gas-oil ratio at 1,000 cu. ft. The well is considered to be a discovery in the upper Wolfcamp.

Schleicher County . . . Plymouth Oil Co. 1-28 Thompson, wildcat 7 miles south of Eldorado, reversed out 10 bbl. of oil and 2 bbl. of heavily oil and gas-cut mud after a 3-hour drill-stem test in the Wolfcamp at 3,266-92 ft.

L. E. Scherck 2 Minnie Wilson, wildcat 10 miles northwest of Fort McKavett, has reported oil recovery on two tests of Canyon sand. A 2-hour test from 4,027-44 ft. had gas in 11 minutes and recovered 3,400 ft. of clean oil. Flowing pressure was 525 psi. and 15-minute shut-in pressure was 1,150 psi. Time on a test from 4,044-56 ft. was not reported, but recovery included 2,340 ft. of clean oil. Top of the Canyon sand was 4,092 ft. on elevation of 2,185 ft. Operators were running electrical logs.

NORTH TEXAS

Cambrian Activity Increases In Nolan County

Cambrian drilling in Nolan County was on the increase again, with new production and extensions reported.

Seaboard Oil Co. 5-A Billie Hanks, 22-Z-T&P, established Cambrian production on the north side of Northwest Hylton field, making

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ft. of oil on a test at 6,518-72 ft. in the Strawn.

TEXAS GULF COAST

Oil Production Opened In New Raywood Strike

Liberty County's Raywood area, previously productive of gas and condensate from 11,000-ft. Cook Mountain sands, has been found productive of oil in a 7,500-ft. Frio sand.

The relatively shallow oil discovery has been made by General Crude Oil Co. and Bankline Oil Co. at their 3 Mitchell, located 150 ft. from a deep gas-condensate well on the same lease. the new well is rated good for 170 bbl. of oil daily, flowing through ⅛-in. choke under pressure of 1,175 psi. Gas-oil raito is 570 cu. ft. per barrel. Gravity of the oil is 35°. Producing interval is 7,563-66 ft.

Rig has been skidded 2,150 ft. southeast for another well to be drilled to the same sand.

Gas-Condensate Tested In Montgomery Wildcat

Testing is under way at Superior Oil Co.'s indicated deep gas-condensate discovery well, 1 Sykes, 1½ miles northwest of Willis, in northern Montgomery County.

In a 4-hour test of a sand interval at 11,198-210 ft., the well, on 16/64-in. choke, flowed at the rate of 92 bbl. of condensate, 40 bbl. of water, and 2,060,000 cu. ft. of gas daily. Condensate had a gravity of 53.5°. Total depth of the hole is 13,100 ft.

Location is about 2½ miles southeast of West Willis field, near production.

Second Producer Proves New Pay at South Rankin

Houston Oil Co. of Texas has opened a new pay zone in its South Rankin gas-distillate field, in northeastern Harris County, where its 1-A Keller et al has been completed in a basal Yegua sand at 8,982-88 ft.

The new pay is more than 500 ft. deeper than the productive level of the company's discovery well, 1 Keller, completed in November 1952, and until now the only producer in the immediate area.

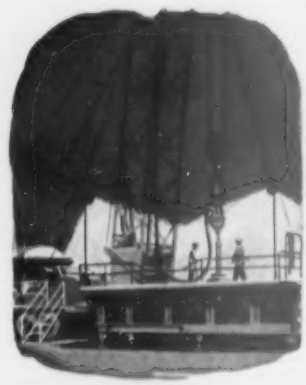
The well, which flowed an ungaged volume of gas and distillate while cleaning through 12/64-in. choke, is shut in pending potential tests. Shut-in pressure is 3,470 psi. Flowing pressure gaged 2,300 psi.

The area is 4½ miles southwest of Huffman.

Matagorda County Field Opens New Dry Gas Sand

James C. Roberts has a new dry-gas producer in the Collegeport-Citrus Grove area of Matagorda County. It is his 1 Hale Unit, dually completed in the area's 4,100-ft. zone at 4,088-4,108 ft., and in a shallower pay at 26795-2,806 ft., a new Miocene sand for the area.

Open flow from the new shallow zone was rated at 11,100,000 cu. ft. of gas daily, having a shut-in pressure of 1,221 psi. Production rate from the deeper regular field sand was calculated at 90,000,000 cu. ft. per day.



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SOUTHWEST TEXAS

Two Locations Made for Texas Offshore Wildcats

Locations for two additional South Texas tidelands wildcat tests were made known the past week, one by Humble Oil & Refining Co. and the other by Sun Oil Co.

Humble will drill in State Tract 794, in the Gulf of Mexico, 3 miles off the coast of St. Joseph Island, Aransas County. Location is 15 miles northeast of Port Aransas, and about 10 miles southeast of East Fulton Beach field, on the mainland side of Aransas Bay, across from St. Joseph Island. Drilling is projected to 12,000 ft. and is expected to get under way late this month.

Sun's test will be drilled from a surface location on the shore of Padre Island, Kenedy County, to a bottom location approximately 2,400 ft. northeast in the Gulf of Mexico under Tract 1018. This location, 27 miles east of Sarita, is 3 miles east of the north tip of Murdock Pass field, on the Laguna Madre side of the island. It will be drilled to 8,000 ft.

SOUTHEAST NEW MEXICO

Delaware Basin Gas Well Plugged by Continental

Continental Oil Co. 1 Bell Lake Unit, in the Delaware basin of Lea County, has been plugged at total depth 12,616 ft. The well stirred considerable interest when it blew out near total depth, burned the rig, and then made a high flow of gas for several weeks. The well was thought to be in the Pennsylvanian at total depth. Top of the Bone Springs was 8,650 ft. and elevation was 3,632 ft. Continental 2 Bell Lake Unit, a long north offset, was drilling ahead and is projected to 13,000 ft.

New Devonian strike . . . Jake L. Hamon and Warren Petroleum Corp. 1 Davis-Federal, Lea County test 2 miles southeast of Knowles-Devonian field, flowed oil on one drill-stem test in the Devonian and recovered oil with no water on two tests, giving the well a possible 72 ft. of pay.

First test from 12,068-12,090 ft. recovered gas in the pipe and 100 ft. of oil; at 12,090-12,120 ft., gas surfaced in 46 minutes and oil in 3½ hours. After cleaning itself it tanked 18.76 bbl. of oil in 1 hour. Flowing pressures and gas-oil ratio were not reported. Third drill-stem test, from 12,120-12,140 ft., had gas in 49 minutes, mud in 5½ hours but did not flow. The well unloaded oil while coming out of the hole. Maximum flowing pressure was 3,000 psi., and 15-minute shut-in pressure was 3,750 psi.

MICHIGAN

A major 1-mile northwest extension of the Northville Trenton formation gas and oil pool, Washtenaw County, appeared likely this week as the Edward Torosian 1 Nerreter, SE SE NE 2-1s-7e, Salem Township, was under test in the Trenton at 4,221 ft. with 400,000 cu. ft. of gas a day showing on initial gage.

Top of Trenton was logged at 4,095 ft. First showing of gas was reported at 4,198 ft. and an increase was reported 117 ft. in the section, at 4,212 ft. Additional gas pay appeared to

have been drilled in the next 9 ft. There was no indication of any oil from the Trenton at this important well up to the last reported depth. The 1 Nerreter is located a flat mile northwest of the W. C. Taggart 1 LeMaster, big, hard flowing Trenton oil discovery well. It is also a short half mile northwest of the Taggart 3 Wilson-Buers Trenton formation shut in gas well, which was developed by deepening an older Salina formation failure to the Trenton. The 3 Wilson-Buers was rated good for about 5,000,000 cu. ft. of gas a day from the Trenton after a 2,000-gallon acid treatment at 4,224 ft., total depth.

A possible Dundee gas discovery well on the Howell anticline was being tested after acidization with 1,000 gal. this week at the McClure Oil Co. and Tom Mask 1 Wilson, NE NE SE 7-3n-4e, Howell Township, Livingston County. Wildcat topped Dundee at 1,046 ft. and showed for a maximum gage of 604,000 cu. ft. a day natural at 1,049-53 ft. Hole was drilled to 1,132 ft., total depth, and was plugged back to 1,058 ft. prior to acid treatment. No results of acidization had been announced, but cleanout operations were in progress.

This new, shallow Howell area gas-showing wildcat, is being drilled on a 500-acre spread farmed to McClure & Mask by Brazos Oil & Gas Co. Brazos controls the balance of the acreage in the play. The 1 Wilson is located just over ¾ of a mile northwest of the Howell Niagara formation gas pool.

CALIFORNIA

Rank Cuyama Wildcat Has Oil Shows

Ditch showings have been reported in a rank wildcat 5 miles east of Taylor Canyon field in the Cuyama Valley. Elmer C. von Glahn and Associates' 1 Washburn, a shallow test drilled in NE NE 36-32s-20e, has been undergoing tests of sand intervals between 1,190 ft. and 1,375 ft., but nothing of commercial importance has been reported. However, operator is presently moving in a much heavier rig and the well will be deepened.

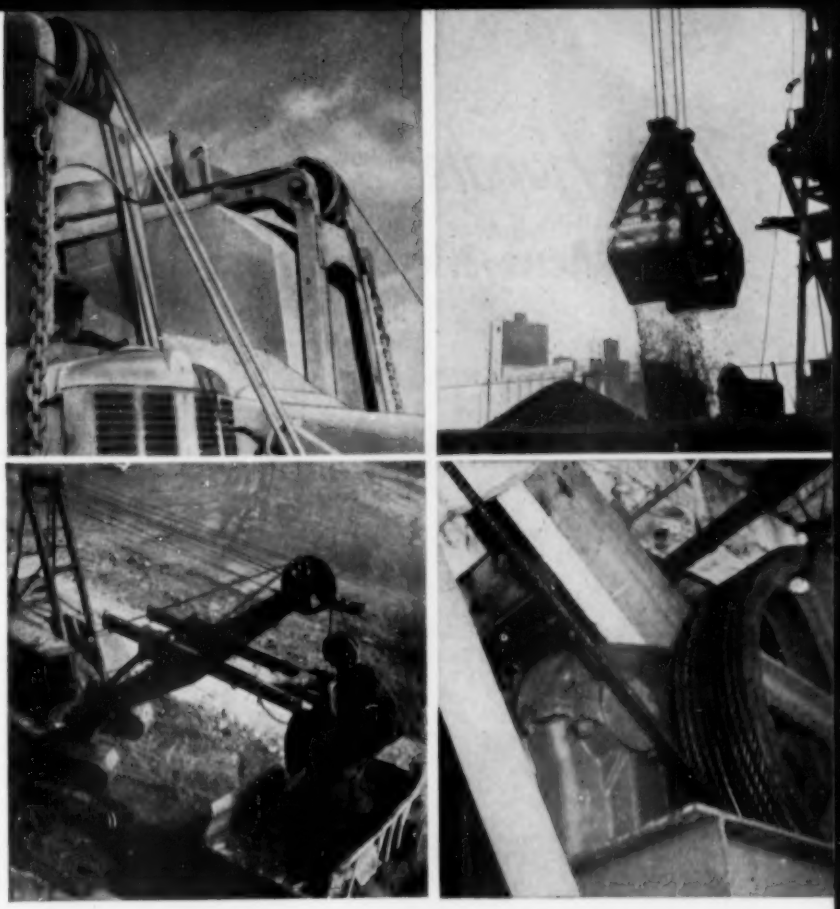
Another Cuyama Valley test will soon get under way with the spudding by Richfield Oil Corp. of 52-22 Russell A, about 9 miles south of the Von Glahn well, in NE NW 22-10n-27w. Location is about midway between Russell Ranch and South Cuyama fields.

Second Well Completed In Degany Gap Pool

A second producer has been completed in the newly-discovered Miller pool at Degany Gap in Kern County. Discovery was made by Gilliland Oil Co. and H. F. Ahmanson whose 1 Miller in SW SE 3-25s-18e is pumping and flowing at the rate of 102 bbl. a day of 22.7°-gravity clean oil through a 14/64-in. choke from 1,667 ft. The second completion, a southerly offset in NW NE 10-25s-18e, was bottomed at 1,903 ft., and took in more sand. This well, the 6A Alferitz, is flowing 200 bbl. a day 27°-gravity oil, 1.8 per cent cut, through a 16/64-in. choke. It was carried about 200 ft. into the Canoas shale. Location has been made for a third well one location west of the discovery.

New West Newport Pool

Victor W. Posta, operator, has made a fault block discovery in West Newport field,



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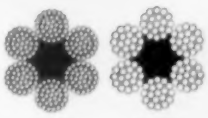

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Orange County. The 2 Estella, located 600 ft. south and 780 ft. west of Hamilton and Bushard Streets on Section 18-6s-10w, is producing about 85 bbl. a day of 20°-gravity oil from the B zone equivalent, top of which was found at 2,452 ft. Production declines have been rather sharp in this area and the discovery is probably of minor importance.

To the northwest in 1-6s-11w between Huntington Beach and West Newport fields, C. D. Cunningham has staked location for 1 Plavan, reportedly a 6,000-ft. test.

ROCKY MOUNTAIN

MONTANA

Cabin Creek Well Finds Madison Oil

Shell Oil Co. recovered oil at the rate of 370 bbl. per day on drill-stem test of Madison at 41-4 NP, NW NE NE 4-9n-58e, in the Cabin Creek unit, Fallon County, Montana. Recovery of oil in Madison is not new in this area, but the formation has been drill-stem tested with only fair results in previous drilling. Completions in the field have been in Silurian and Ordovician.

Test at the current well was of the interval 7,357-7,420 ft. Tool was open 4 hours. The flow of oil was accompanied by water at the rate of 555 bbl. per day. Flow began after 95 minutes, and changed from mud to muddy oil, then to muddy, watery oil, and to watery oil.

Shell is reported drilling ahead below 8,127 ft. The well is ½ mile south of established production. The operator has made no statement as to whether a Madison completion may be attempted.

Dynneson Confirmation Still Testing Madison

Sun Oil Co. and Phillips Petroleum Co. are still testing Madison at 2 Dynneson, C SW SW 29-24n-58e, in the Brorson area of Richland County. The operator recovered oil at rates up to an estimated 150 bbl. per day on test of Madison perforations 9,041-70 ft. New perforations 9,128-9,220 ft. were acidized and Sandfract and flowed acid and fracturing materials with traces of free oil at the beginning of tests now in progress. This well was staked as a confirmation of the Ordovician discovery in this area, but will be the first Madison discovery in the area east of the Cedar Creek anticline if successfully completed in this formation.

NORTH DAKOTA

New Central North Dakota Exploration In Prospect

Activity through North Dakota's central and east central counties on the eastern side of the Williston basin has increased with two substantial wildcat programs in progress.

S. D. Johnson of Denver has made location for four additional tests in a series currently being drilled on farmouts from Union Oil Co. of California. Johnson is now completing 1 Tinglestad, SW SE 3-163n-70w, the third in the series. New locations are in NW NW 4-143n-69w, Stutsman County, in NE NE 30-145n-68w, Wells County, and SE SE 17-145n-66w, Foster County.

Hunt interests of Dallas have announced a forthcoming program of 15 wildcats through this area. Caroline Hunt Trust Estate has

spudded 1 Fuller, SW SE 6-136n-73w, in Logan County. Other locations have not been announced but the series will include six wells in Burleigh County, four in Sheridan County, three in Wells County, and one in Kidder County.

In McHenry County, J. P. Owen is drilling the last of a five-well series at 1 Bromley, SE NW 27-153n-75w. Owen and Hyde and associates have drilled four previous wells on farmouts from Carter Oil Co. and Continental Oil Co. through Bottineau, Pierce, and McHenry counties.

WYOMING

Dakota Discovery in Niobrara County Tested

Continental Oil Co. has reported a recovery of 360 bbl. of oil per day on swab and flowing by heads from 1 Government, NE SE SW 2-35n-64w, south of South Little Buck Creek field, Niobrara County. The well is only about ¾ of a mile south of production, but is separated from the field proper by dry holes, and is believed on a separate structure. Test was of the perforated interval 4,012-22 ft. Top of Dakota was found at 4,013 ft.

WASHINGTON

Continental Oil Co.'s first exploratory well in the State of Washington is drilling below 3,600 ft.

Well is the 1 Sims and location is in the southwest quarter of Section 31-19n-8e, about 8 miles northeast of Aberdeen in Grays Harbor County. The company is engaged in a comprehensive program of exploration for oil and gas in the western part of the state. Drilling is being carried on with the company's own tools.

MISSISSIPPI

Wilcox Sand Produces In Jefferson County Strike

Initial tests by Clyde E. Moss and Crow Well Service Co. at their 1 Noble, a wildcat located approximately 2½ miles northwest of Fayette field, in northwestern Jefferson County, have virtually assured the opening of another Wilcox oil field.

Open 17 hours with casing perforated at 3,914-16 ft., the well flowed at the rate of 64 bbl. of oil daily while cleaning through 10/64-in. choke. Production carried a small amount of water. Flow pressure was 130 psi.

The well had been drilled to 6,015 ft. and has casing run to 4,050 ft. Pay is identified as the Stewart "A" sand, productive until now only in Fayette field.

WILDCAT COMPLETIONS

SOUTHWEST TEXAS
District 1

Bastrop County: R. W. Champion 1 Casey, E. Standifer Sur. Shut down. TD 620 ft.

Caldwell County: Hamilton Beazley and A. T. Wagner 1 Moore, Dorothy Benton Sur. 4. Dry. TD 1,741 ft.

Frio County: Howeth & Mason 1 Vaughn-Jackson, Pedro Flores Morales Sur. 1413, A-430. Dry. TD 4,092 ft.

A. T. Jergins 1 McDonald, Justis Wurzbach 182, A-661. Dry. TD 4,252 ft.

Producers Corp. of Nevada 1 Mills, Sec. 24,

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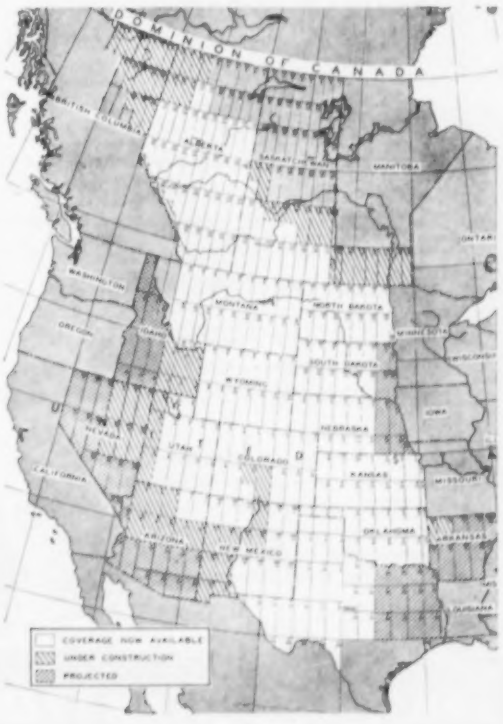

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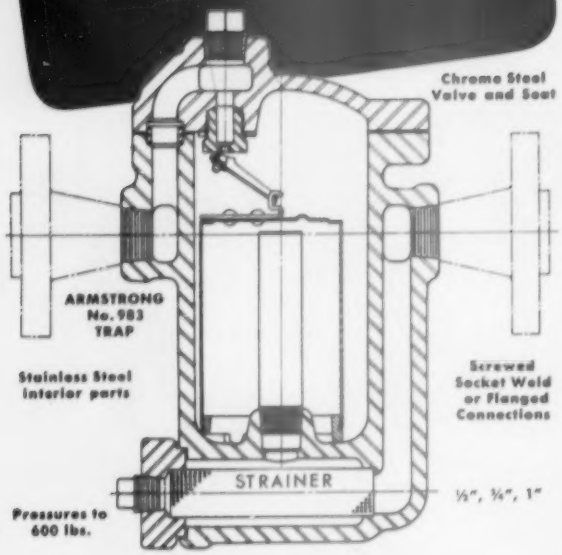

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Write for further information and catalog.

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WILDCAT COMPLETIONS

Frio County School Land Sur. 3, A-308. Dry. TD 4,843 ft.

LaSalle County: Dale & Rowden 1 Nueces, Cresencio Rodriguez Sur. 223, A-635. IPP 3.5 BOPD net, 26°, Mirando sand 417-19 ft. TD 455 ft. (New field, Como).

Williamson County: Andrew M. Wilbern 1 Fuchs, Francis Bradley Sur., A-78. Dry. TD 1,102 ft.

Zavala County: Henshaw Brothers and K. D. Harrison 1 Kiefer et al, Lettis Grimes Sur. 50, A-1320. Dry. TD 3,100 ft.

District 4

Aransas County: F. W. Carr 2 Murray Est., Block 62, McCampbell Subd., James Orick Sur., A-167. Dry. TD 7,515 ft.

Hidalgo County: George H. Coates 1 Guerra, San Salvador del Tule Grant. Dry. TD 8,844 ft.

Jim Hogg County: John F. Camp & Sons 1 Marrs McLean Est., Lot 44, Section 9, Holbein Subd., Las Animas Grant, A-244. Dry. TD 3,114 ft.

O. W. Killam 1 Hellen, Duval County School Land Sur. 150. Shut down. TD 3,531 ft.

Jim Wells County: R. S. Hays 1 West, Casa Blanca Grant. IP 22.41 BOPD, P-33 choke, 45.1°, perforations 5,735-37 ft. TD 5,804 ft. (New field).

San Patricio County: Kirkwood & Co. and W. C. Weaver 1 Willis, Lot 1, Block 10, 1st Subd., Taft Farm Lands. Dry. TD 5,303 ft.

Starr County: Sinclair Oil & Gas Co. 1 de Garza, Porcion 105. Dry. TD 3,500 ft.

Tri-Mark Oil Co. 1 Margarita Pena de Gutierrez, El Puerto Ranch Partition, Share 14, Sur. 85. Dry. TD 1,105 ft.

Webb County: Appell Oil & Gas Co. 1 Walker, CCSD&RGNG Sur. 52, A-2606. Dry. TD 2,501 ft.

Goldstein Oil Corp. 1 Marrs McLean, CCSD&RGNG Sur. 60, A-2206. Dry. TD 4,065 ft.

TEXAS GULF COAST

District 2

Jackson County: Brewster-Bartle Drilling Co., Inc., 1 L. Ranch, Lot 127, LaWard Farms Subd., I&GN Sur. 26, A-155. Dry. TD 9,012 ft.

N. B. Hunt 4 Hollingsworth, Lot 1, Eli Mercer Sur., A-54. IP 1,370 M.c.f. daily, open flow, lower Frio perforations 4,160-88 ft., and 1,820 M.c.f. daily, open flow, upper Frio perforations 3,530-41 ft. TD 4,762 ft. (New field).

Magnolia Petroleum Co. 1 McDaniel, Elisha Burton Sur. Dry. TD 4,810 ft.

Karnes County: J. M. Taylor 2 Janssen, Victor Blanco Grant, A-3. IPP 59.34 BOPD, 47°, perforations 4,116-25 ft. TD 4,144 ft. (New pay in Janssen field).

Live Oak County: Barry & Moore 2 Jones, AB&M Sur. 271, A-62. Dry. TD 4,261 ft.

Inca Drilling Co. 2 Miller, Jose Aldrete Sur., A-1024. Dry. TD 4,626 ft.

Ussery Drilling Co. 1 McWhorter, W. J. Cannon Sur., A-141. Dry. TD 4,529 ft.

Refugio County: Caroline Hunt Sands 2 Bauer, George W. Maine Heirs Sur., A-218. Dry. TD 9,900 ft.

District 3

Brazoria County: E. Cockrell, Jr., 1 Moller, Thomas Grayson Sur., A-196 (Stratton Ridge area). Dry. TD 9,238 ft.

Chambers County: Sun Oil Co. 1 State Tract 132, Galveston Bay (Red Fish Reef area). Dry. TD 9,681 ft.

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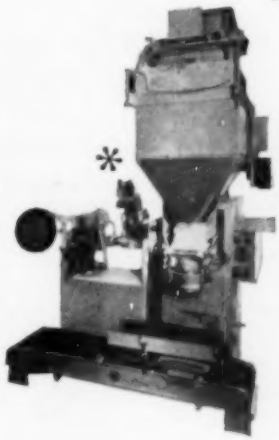

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WILDCAT COMPLETIONS

Galveston County: John W. Mecom and Union Producing Co. 1 University of Texas, Sam Bundick Sur., A-7. Dry. TD 7,158 ft.

Harris County: Lago Petroleum Co. 1 Wunsche, Howard Decrow Sur., A-221. Dry. TD 7,531 ft.

Olympia Oil & Gas Co., Ltd., 1 Andrews et al, A. McCormick Sur., A-46. Dry. TD 5,946 ft.

Olympia Oil & Gas Co., Ltd., 1 Fredie Trichelle et al, A. McCormick Sur. Dry. TD 7,652 ft.

Jefferson County: Continental Oil Co. 1 Click, Dan Easley Sur., A-20. Dry. TD 7,325 ft.

Liberty County: John W. Mecom et al 1 Partlow et al, M. Whittington Sur., A-398. Dry. TD 9,360 ft.

Matagorda County: Sun Oil Co. 1 Junek, Thomas Jamison Sur., A-51 (El Maton area). Dry. TD 11,500 ft.

Montgomery County: Simonton & Talley 1 Anna Platt estate, William Barker Sur., A-82. Dry. TD 7,450 ft.

EAST TEXAS

Cherokee County: Bill R. Tipton 1 L. Jones, J. M. Musquez Sur., A-37. Dry. TD 4,496 ft.

Ellis County: Bryant & Bagby 1 Erisman, MEP&P Sur., A-167. Dry. TD 650 ft.

Hopkins County: W. B. Hinton 1 McQueen, Russell B. Craft Sur. Dry. TD 7,226 ft. Paluxy 5,120 ft., Bacon limestone 6,370 ft.

Houston County: Sid Katz Exploration Co. 1 Moody, James Moncure Sur., A-759. Dry. TD 6,005 ft. Elev. 285 ft., Woodbine 5,952 ft.

Navarro County: R. S. Hamilton 1 Nesbett, Pedro Quero Sur., A-669. Dry. TD 3,420 ft.

T & L Oil Co. 1 Osteen, J. T. Bell Sur., A-43. Dry. TD 1,650 ft.

Panola County: Rudco Oil & Gas Co. 1-B Rudman & Genecov, T. W. Walden Sur., A-698. Dry. TD 6,966 ft. Elev. 300 ft. Travis Peak 6,750 ft.

TEXAS PANHANDLE

Gray County: The Texas Co. 1 Mathers, Sec. 22, M-2, H&GN Sur. Dry. TD 4,581 ft.

Sherman County: Cherry Bros. 1 Ross, Sec. 30, I-T, T&NO Sur. Dry. TD 3,720 ft.

Humble Oil & Refining Co. 1 Brown, Sec. 61, I-T, T&NO Sur. IP 14,000,000 cu. ft. gas, pay 3,223-3,495 ft. TD 3,495 ft.

WEST CENTRAL TEXAS

Brown County: Davis Drilling Co. 1 Wilson, Sec. 24, HT&B Sur. Dry. TD 1,325 ft.

Callahan County: Callihan Rotary Co. 1 Estes, 66-14-T&P. Dry. TD 4,570 ft. Elev. 1,803 ft., Caddo 4,390 ft.

Johnson & Warren 1 Keele, G. W. Denton Sur. 347. Dry. TD 1,574 ft.

Johnson & Warren 1 Hugh Ross, Jr., Sec. 102, BBB&C Sur. Dry. TD 1,681 ft.

Pethybridge & Erlich 1 Scott, Mial Surlock Sur. 207. IP 60 BOPD, 16/64-in., 42°, Cross Plains sand 1,810-12 ft. TD 1,816 ft.

Coleman County: K. C. Bates 1 Johnson, E. G. Moffett Sur. 232. Dry. TD 1,350 ft.

G. B. Cree 1-A Morris, 86-2-GH&H. IP 71 BOPD, 12/64-in., 43°, pay 2,309 ft. TD 2,355 ft.

Fisher County: Ted Weiner 1 Famby, 188-3-H&TC. Dry. TD 6,145 ft. Elev. 2,147 ft., Canyon 5,990 ft.

Haskell County: W. H. Hunt 1 Scott, E. W. Taylor Sur., A-393. Dry. TD 5,845 ft.

Jones County: Capitol Co. 1 Moore, 33-14-T&P. Dry. TD 2,295 ft.

Edgar Davis Drilling Co. 1 Walling, 19-19-T&P. IP 114 BOPD, 15/64-in., 41°, pay 4,793 ft. TD 4,811 ft.

West Central Drilling Co. 1 Irvin, Godwin Subd., DeWitt CSL Sur. Dry. TD 4,986 ft.

Robert Wheelock, Jr., and B. L. Coulson 1 Sauls, 180-1-BBB&C. Dry. TD 3,655 ft.

Nolan County: Lowry Oil Co. 1 Frank Allyn, 49-20-T&P. Dry. TD 6,209 ft. Elev. 2,209 ft., Ellenburger 5,854 ft.

Payne-Johnson-Byars 1 Hale, 49-20-T&P. Dry. TD 6,280 ft.

Palo Pinto County: Palo Pinto Oil & Gas Corp. 1 Allen, D. B. Brooks Sur., A-53. Dry. TD 4,005 ft.

Shackelford County: Schkade Bros. Drilling Co. 1 Hooker, 24-11-T&P. Dry. TD 1,492 ft.

Stonewall County: Hunt Oil Co. 1 Bryan, Sec. 15, Wm. Vardeman Sur. 348. Dry. TD 6,385 ft.

Taylor County: B. G. Byars 1 T&P RR, 36-19-T&P. Dry. TD 5,050 ft.

G. B. Cree 1 Hefley, Joshua Gray Sur. 465. Dry. TD 4,111 ft.

Landa Oil Co. 1 Bowers, 42-19-T&P. Dry. TD 6,023 ft.

Throckmorton County: Gilchrist Drilling Co. 1 Bellah, Sec. 916, TE&L Sur. Dry. TD 4,687 ft.

NORTH TEXAS

Clay County: Warren Petroleum Corp. 1 Hagar, TE&L Sur., 3,202 ft., 3 mi. NW Shannon. IP 145 BOPD, 24/64-in., 42°, pay 4,406 ft. TD 4,497 ft.

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WILDCAT COMPLETIONS

Grayson County: Ada Oil Co. 1 Allen, G. T. Brunk Sur., A-169, 3½ mi. E Whitehorse. IPP 140 BOPD, 31°, Strawn 5,392 ft. TD 6,453 ft.

Edwin L. Cox 1 Bryan, W. G. Miller Sur., A-78. Dry. TD 5,112 ft.

Jack County: Moncrief-Wiley Oil Co. 1 Rogers, Wm. McDonald Sur., A-378. Dry. TD 453 ft.

Walter L. Plemons Production Co. 1 Hickman, D. J. E. Clark Sur. Dry. TD 3,053 ft.

Wichita County: Paul Bilbrey and Wayne Albritton 2 Padgett, Sulphur Fork Iron Works Co., Sur. 1, A-278. Dry. TD 394 ft.

Young County: Grace & Ford Drilling Co. 1 Gragg, A. Hohus Sur., A-240. Dry. TD 3,801 ft.

WEST TEXAS

Coke County: Group Oil Co. 1 Gideon, N. Eastland Sur. 331. Dry. TD 5,600 ft.

Crockett County: LaGorce Oil Co. and Garlitz-Howell 1 Holt, 62-OP-GC&SF. IP calculated 2,300,000 cu. ft. gas in 6 hr., pay 1,402 ft. TD 8,018 ft.

John L. & P. D. Moore 1-Q Texaco, 11-10-GC&SF. IPP 18 BOPD, 27°, pay 1,820 ft. TD 1,823 ft.

Gaines County: Guy Mabee Drilling Co. 1 Schumacher, 22-298-Reagan CSL. Dry. TD 12,826 ft. Elev. 3,034 ft., Strawn 11,195 ft., Devonian 12,782 ft.

Garza County: R. S. Anderson 1 Windham, 684-97-H&TC. Dry. TD 2,616 ft.

Hale County: Western Drilling Co. 1 Bickley, 23-DT-HE&WT. Dry. TD 6,510 ft.

Howard County: R. L. Cannon 1 Rudi, 26-31-T2N-T&P. Dry. TD 9,913 ft. Elev. 2,672 ft., reef 8,273 ft., Ellenburger 9,766 ft.

Cosden Petroleum Corp. 1 Phillips, 42-34-T1S-T&P. Dry. TD 4,069 ft.

Jake L. Hamon 1 Quinn, 35-34-T1S-T&P. Dry. TD 3,351 ft.

Kent County: Twin Oil Corp. 1 Wallace, 67-4-H&GN. Dry. TD 7,171 ft. Elev. 1,966 ft., Strawn 6,932 ft., Mississippian 7,111 ft.

Motley County: General Crude Oil Co. 1-43-E Swenson, 43-B-John H. Stephens Sur. Dry. TD 4,807 ft. Elev. 2,200 ft., Pennsylvanian 3,436 ft., pre-Cambrian 4,729 ft.

Pecos County: Eastham & Russell 1 Wilson, 10-145-T&STL Sur. IP not reported, completed as shut-in gas well. Flowed estimated 250,000 cu. ft. gas from 1,184-1,208 ft. TD 4,766 ft.

Phillips Petroleum Co. 1-K Puckett, 37-101-TCRR Sur., 3 mi. NW of nearest Puckett well. IP calculated open flow 33,000,000 cu. ft. of gas, Ellenburger 12,384-13,328 ft. Elev. 3,376 ft., top Ellenburger 12,360 ft. TD 13,780 ft.

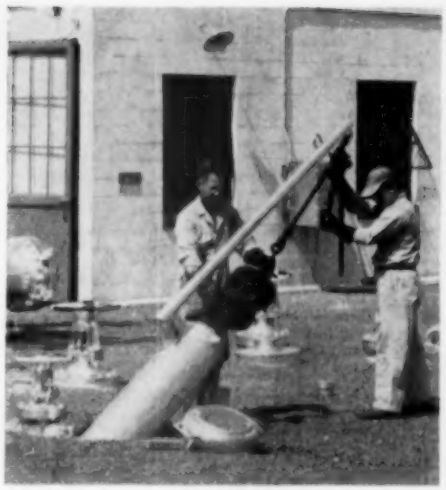
Reagan County: Phillips Petroleum Co. 1-ZZ University, 16-6-University Lands Sur. Dry. TD 11,836 ft. Elev. 2,725 ft., Devonian 9,130 ft., Ellenburger 10,200 ft., pre-Cambrian 11,814 ft.

Reeves County: Francis K. Campbell 1 Wilson, 27-56-PSL. Dry. TD 3,854 ft.

Schleicher County: Union Oil Co. and Lario Oil & Gas Co. 1 McElroy, 86-LL-TCRR. Dry. TD 5,820 ft. Elev. 2,310 ft., Strawn reef 5,790 ft.

Scurry County: Sun Oil Co. 2 Layne, 175-97-H&TC. Dry. TD 6,974 ft. Elev. 2,375 ft., reef 6,953 ft.

Upton County: Hunt Oil Co. 2-106 Amacker, 106-D-CCSD&RGNG, 14 mi. NW Rankin, 1½ mi. W of 1 Amacker. IP 528



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WILDCAT COMPLETIONS

BOPD, 8/64-in., 52°, pay 11,950 ft. TD 12,376 ft.

ILLINOIS

Bond County: The Texas Co. 1 Smith, NW SE SE 13-5n-2w. Dry. TD 2,730 ft.

Clinton County: G. J. Goldschmidt 1 Huelsmann, NE SE NE 10-2n-4w. Dry. TD 2,348 ft.

L. Kapp 1 Koelling, NW NE NE 20-1n-1w. Dry. TD 1,401 ft.

Edgar County: E. Zink 1-B Stark, SE NW NE 18-12n-13w. Dry. TD 650 ft.

Jersey County: Carl Jansen 1 Ringhausen, NE NW SW 23-8n-13w. Dry. TD 950 ft.

Macon County: Shulman Bros.-Ohio Oil Co. 1 Scroggin, SE SW NW 27-16n-1e. Dry. TD 2,011 ft.

Randolph County: Barton & Barton 1 Macmasters, SW SW NE 23-4s-6w. Dry. TD 2,300 ft.

White County: Calvert Drilling Co. 1 Powell, SEc 31-3s-10e. Dry. TD 3,346 ft.

INDIANA

Dubois County: H. C. Henderson 1 Bretz, SW NE SE 36-2s-5w. Dry. TD 826 ft.

Perry County: L. B. Hafferty 1 Sigler, NW NW NW 20-3s-2w. Dry. TD 1,205 ft.

Warrick County: Truman W. Drake 1 Johnson, SE SE NE 36-4s-6w. IPP 10 BOPD, lower O'Hara. TD 1,185 ft. (Discovery well of North Gentryville pool.)

KENTUCKY

Henderson County: Roy Pledger et al 1 Latta, SE NW SW NE 7-P-21. IPP 18 BOPD, Tar Springs. TD 2,710 ft. (Extends Hitesville pool.)

MICHIGAN

Allegan County: Michigan Oil & Gas Drilling Co. 1 Overhiser, NE NE NE 22-1n-16w. Dry. TD 1,230 ft. in Traverse lime.

Cass County: Miller Brothers 1 Steele, SE NE NE 36-7s-15w. Dry. TD 815 ft. in Traverse lime.

Newaygo County: John F. Melvin 1 Laurent, NW NW NE 36-12n-14w. Dry. TD 2,718 ft. in Dundee.

Washtenaw County: Wm. L. Durham 1 Knight, NW NE NW 26-4s-4e. Dry. TD 1,037 ft. in Detroit River.

OHIO

Coshocton County: National Gas & Oil Corp. 1 James Waring, Second quarter. IP 30 BOPD, Clinton 3,470-3,520 ft., TD 3,530 ft.

WEST VIRGINIA

Randolph County, Middle Fork district: Bobray Exploration Co. 1 Chester C. Housh, elevation 2,407 ft., 25,000 cu. ft. gas, Bayard sand 1,488-505 ft., gas 1,494 ft., TD 1,600 ft.

Roaring Creek district, Nollem Oil & Gas Corp. 4 Goff-Arnold Land Co., elevation 2,604 ft., 1,566,000 cu. ft. gas, Fifth sand 2,243-2,295 ft., gas 2,256-2,295 ft., TD 2,299 ft.

FLORIDA

Okaloosa County: Sun Oil Co. 1 Harbeson-Wright, C SW SE 13-4n-22w. Dry. TD 5,420 ft. Elev. 158 ft., Lower Cretaceous 5,112 ft.

MISSISSIPPI

Adams County: Jett Drilling Co. and H. W. Elliott 2 Boger, 44-6n-2w. Dry. TD 6,627 ft., Elev. 389 ft., Wilcox 4,467 ft., Minter zone 6,591 ft.

Forrest County: I. P. La Rue 1 Batson, 29-1n-13w. Dry. TD 9,015 ft. Elev. 343 ft., lower Tuscaloosa 8,472 ft.

George County: I. P. La Rue and Stanford Drilling Co. 1 Stringfellow, C NE NW 15-2s-5w. Dry. TD 8,515 ft. Elev. 149 ft., Lower Cretaceous 8,377 ft.

Jefferson County: Durbin Bond, Inc., and Petersen Drilling Co. 1 Sanders, 6-8n-1w. Dry. TD 6,210 ft. Elev. 271 ft., Wilcox 3,872 ft., Artman zone 5,573 ft.

ALABAMA

Clarke County: Gulf Refining Co. 2 Neal, C NE SE 25-7n-3e. Dry. TD 5,765 ft. Elev. 176 ft., Lower Cretaceous 5,520 ft.

SOUTH LOUISIANA

St. Landry Parish: Feazel Interests and Texas Gas Production Co., Inc., 1 Opelousas-St. Landry, 66-4s-3e. Dry. TD 8,404 ft.

St. Mary Parish: Atlantic Refining Co. 7-B Adeline, 37-13s-9e. IP 10.6 BOPD, 12/64-in., 32°, perforations 2,050-57 ft. TD 5,301 ft. (New pay in South Jeanerette field).

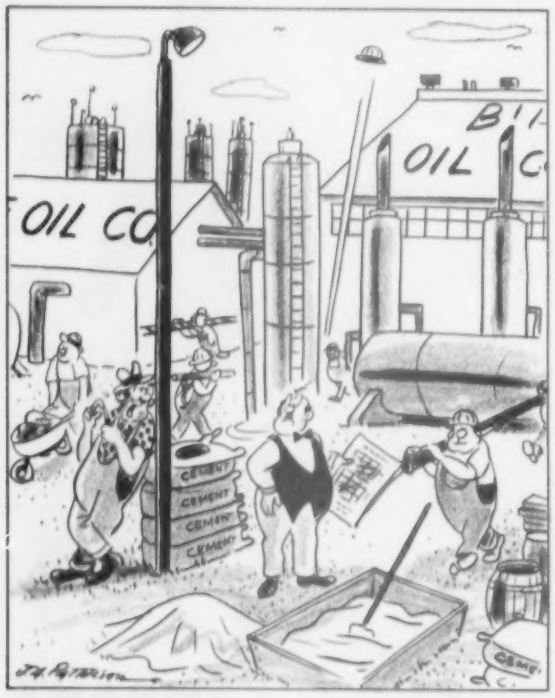
Vernon Parish: Magnolia Petroleum Co. 1 Pickering, C NE NE 8-3n-8w. Dry. TD 8,525 ft.

NORTH LOUISIANA

Concordia Parish: H. L. Rowley 1 Abner Maxwell, 36-3n-8e. Dry. TD 8,003 ft.

Interstate Natural Gas Co. 2 Learned, 46-2n-8e. IPP 99 BOPD, Minter-Wilcox 8,090-91 ft., 43.1°. TD 9,000 ft. (New pay in Black Hawk field.)

Sabine Parish: T. C. Liddell 1 Kunge, 25-6n-11w. Dry. TD 152 ft.



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WILDCAT COMPLETIONS

ARKANSAS

Calhoun County: Western Production Co. 1 Stringfellow, 7-15s-13w. IPP 15 BOPD, Meakin 2,560-2,578 ft. TD 2,578 ft. (Northwest outpost to Artesian field.)

Columbia County: Southwest Gas Producing Co., Inc. 1 Walthall, 32-16s-20w. Dry. TD 8,144 ft.

Union County: Lawton Oil Corp. B-7 Union Saw Mill, 35-18s-14w. IPF 1,500 M.c.f. of gas per day, lower Graves, open hole, TPSI 1,000. TD 2,668 ft. (New pay at South Hibank field.)

OKLAHOMA

Beckham County: Burt Drilling Co. 1 Van Vector, NW NW NW 29-8n-21w.Dry. TD 1,480 ft.

Caddo County: The Texas Co. 1 King, SW NE SW 26-5n-11w. Dry. TD 7,512 ft.

Shell Oil Co. 1 McDaniel, NE NE SW 6-5n-11w. Dry. TD 3,398 ft.

Carter County: H. M. Hughes 1 Boone, NE SE NE 2-1s-3w. Dry. TD 6,872 ft.

Comanche County: Stanolind Oil & Gas Co. 1 Perdasofty, SE NW SW 11-4n-12w. Dry. TD 9,674 ft.

Creek County: Thompson & Roley 1 Monte Hill "B," SE NW SE 33-17n-9e. Dry. TD 1,489 ft.

Garvin County: W. O. Smith 1 Cherry, SE SE SW 26-4n-3e. Dry. TD 1,903 ft.

Max Pray 1 Davenport, SW SW NE 10-4n-2w. Dry. TD 6,772 ft.

Jefferson County: Sinclair Oil & Gas Co. 1 Beavers, NW NW SE 34-3s-6w. Dry. TD 3,950 ft.

Kay County: H. Waggoner & Co. 1 Lockhart, NW SW SW 32-29n-2w. Dry. TD 4,635 ft.

Lincoln County: N. V. Duncan 1 Graper, SE SW SE 20-12n-5e. Dry. TD 4,702 ft.

Harvey et al 1 Turnbull, NW NW SE 32-15n-6e. Dry. TD 4,565 ft.

Noble County: Wilson Petroleum Co. 1 Carrier, SW SW NW 25-21n-2w. Dry. TD 2,285 ft.

Pawnee County: Herman Taylor 1 Buzan, NE NE NE 11-22n-4e. Dry. TD 3,420 ft.

Signal Oil & Gas Co. 1 Crosby, SE SE SE 14-22n-5e. IPF 3,300 M.c.f. of gas per day, Skinner sand 2,946-56 ft., 6/64-in. TD 3,438 ft. (Gas discovery).

Pontotoc County: W. T. Shelton 1 Wingard, SW SW SW 25-2n-5e. Dry. TD 84 ft.

Washita County: Gulf Oil Corp. et al 1 Goeringer, C NE SE 28-11n-16w. IPF 13 BOPD, Des Moines 12,299-455 ft., 43°, ½-in. TD 12,559 ft. (Oil discovery).

KANSAS

Barber County: Aylward Drilling Co. et al 1 Keimig, SW SW SE 28-30s-11w. Dry. TD 4,870 ft.

Buffalo Oil Co. and GMR 1 Updegraff, NE NE NE 15-31s-12w. Dry. TD 4,865 ft.

Decatur County: Jones, Shelburne & Farmer 1 Fortin, NE NE NE 17-2s-27w. Dry. TD 3,989 ft.

R. W. Shields 1 Coleman, SW SE SE 15-4s-27w. Dry. TD 3,800 ft.

Cowley County: Royal Oil Co. 1 Nitschke, SE SE SE 24-32s-6e. Dry. TD 2,290 ft.

Greenwood County: Adair Oil Co. 1 Houston, NE NW SW 7-26s-9e. Dry. TD 2,410 ft.

McPherson County: Seeger Oil & Gas Co. 1 Koelsch-Oswald, SE SE NE 18-19s-5w. Dry. TD 3,500 ft.

Pawnee County: Imperial Drilling Co. 1

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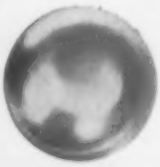

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WILDCAT COMPLETIONS

Black, SW NW SW 11-20s-18w. Dry. TD 4,064 ft.

Welch & Olson 1 Bryant, SW SE NW 11-21s-20w. Dry. TD 4,500 ft.

Duke & Wood 1 Schartz, NE NE SE 36-22s-16w. Dry. TD 4,154 ft.

Rooks County: Morrison Drilling Co. 1 Old Peoples Home, NW SE SW 14-6s-18w. Dry. TD 3,575 ft.

Nadel & Gussman 19 Hinkhouse, NW SE SW 27-9s-20w. IPP 454 BOPD, Lansing 3,596-3,600 ft. TD 3,812 ft. (New pay at Northampton).

Francis Oil & Gas Co. 4 Wilson "C," SW SE NE 35-9s-20w. IPP 130 BOPD, Lansing 3,678-90 ft. TD 3,863 ft. (New pay at Northampton Southeast).

Rush County: Lee Phillips 1 Herrman, NW NW SW 23-16s-18w. Dry. TD 3,642 ft.

NEBRASKA

Dawes County: Cree Drilling Co., Inc. 1 State, C SE SE 16-29n-49w. Dry. TD 5,008 ft. in Sundance.

Kimball County: Love & Zoller 1 Johnson, SW SW SE 35-16n-54w. Dry. TD 5,885 ft.

NORTH DAKOTA

Divide County: Pure Oil Co. 1 Gunderson, SW NW 11-160n-98w. Dry. TD 8,066 ft. in Madison.

Pierce County: J. P. Owen-Hyde & Associates 1 Hager, NE NE 6-152n-73w. Dry. TD 3,412 ft. in Lodgepole.

Rolette County: Ward-Williston Drilling Co. 1 State "B," SE SW 11-161n-72w. Dry. TD 3,300 ft. in Nisku.

S. D. Johnson 1 Bryant estate, SW NW 31-164n-70w. Dry. TD 3,057 ft. in Duperow.

Stark County: Hunt Oil Co. 1 Kudrna, C SW NW 20-139n-97w. Dry. TD 10,506 ft. in Duperow.

CALIFORNIA

Colusa County: Richard S. Rheem, Opr. 1-30 Capital Co., 30-18n-1w. Dry. TD 3,000 ft.

Kern County: Richfield Oil Corp. D-3 San Emidio, 32-11n-21w. Dry. TD 6,416 ft.

Union Oil Co. 57-26 Reserve-Tejon, 26-11n-19w. Dry. TD 10,371 ft.

Gilliland Oil Co. and H. F. Ahmanson 1 Miller, SW SE 3-25s-18e, IPF BOPD, 24/64-in. choke, TD 1,667 ft. (New pool discovery Degany Gap.)

Madera County: Tide Water Associated Oil Co. 1-6 Southern Realty, 6-10s-14e. Dry. TD 8,369 ft.

Success Oil Co. 1 Andrews 32-10s-18e. Dry. TD 2,199 ft.

Merced County: Shell Oil Co. 36X-11 R. R., 11-10s-13e. Dry. TD 6,012 ft.

Santa Barbara County: Apex Petroleum Co. 4-1 Hollister, 36-5n-34w. Dry. TD 896 ft.

Ventura County: Continental Oil Co., and Union Oil Co. 1 Berylwood Investment Co., 18-2n-20w. Dry. TD 9,206 ft.

Orange County: Victor W. Posta, Opr. 2 Estella, 18-6s-10w, IPP 208 BOPD, 6 BWPD, 21.4° gravity, TD 2,491 ft. (New fault block discovery West Newport area.)

MONTANA

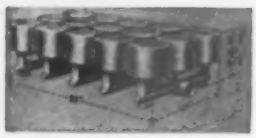
Musselshell County, Melstone area: Amerada Petroleum Corp. 2 H&H Ranch, C SW SW 8-10n-29e. Dry. TD 4,512 ft. in Amsden.

WYOMING

Lincoln County: Belfer-Justheim J-2 Government, C NW NW 28-24n-113w. Dry. TD 6,513 ft. in Mesaverde.

(Continued on page 202)

INFERNO



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New Pipeline Head

Wilson assumes presidency of Interstate on June 1

GEORGE A. WILSON has learned that he can combine his first two loves, but in the process he has almost lost two others—his pet hobbies.

Wilson, who takes over as president of Interstate Oil Pipe Line Co. June 1, has done such a good job combining law and the oil business, he's in a top management job. As a result he hasn't much time left to hunt and fish—or operate hotrod sport cars.

One of Louisiana's oldest oil fields is indirectly responsible for this wedding between law and oil as far as the new Interstate president is concerned. He was born and reared at Mansfield, La., near the old Naborton oil field which came in about 1911. The oil industry fascinated him from the beginning as "an active and glamorous business in some respects," but Wilson wanted to study law. He did and almost immediately after he received his LL.B. degree at Tulane University he started becoming a specialist in oil and gas law.

He's a specialist . . . His specialization was so expert that he taught oil and gas law at his alma mater and practiced law in New Orleans until 1940 when he took on a "Boy Scout" chore. Acting as general counsel for the Louisiana Conservation Department Wilson rewrote the state's oil and gas code and then helped "shepherd" the new code through the legislature. In 1941 he became head of the production and pipeline law department of the old Standard Oil Co. of Louisiana.

During World War II, Wilson was at times "surprised" to find himself "in a terrific rat race"—wartime Washington. There he undertook an intensive job as director of supply and transportation for the Petroleum Administration for War. Wilson found himself involved in this project in the same way that other industry leaders did. When concern over petroleum supply reached a pitch, the Government beckoned and Wilson responded. He left the PAW in 1945 after "most of the shooting was over and we knew pretty well where we were going."

Appointed president of Interstate Natural Gas Co., a Jersey Standard affiliate, in 1946, Wilson headed the gas transmission company until last year when Jersey sold its controlling interest. His most recent job has been as assistant to the coordinator for Jersey Standard in New York.

From gas to oil . . . Wilson concedes it will be quite a change to move from a natural-gas pipeline company to an oil pipeline with 2,700 miles of trunk lines in five states. It'll mean an end to gas production, land and lease problems and "living with the FPC" and a "switch to consent decrees and the ICC," Wilson says with a chuckle.

It's also going to mean that Wilson's hunting and fishing will suffer in just the same way they have for a number of years. The sports car hobby has just about become a thing of the past. He disposed of his last model when he last went to New York and the populous East.

"I couldn't imagine anything any more useless in Manhattan than a big hotrod."

James Helis, formerly assistant regional drilling supervisor of Atlantic Refining Co.'s Oklahoma-Kansas area, headquartered in Tulsa, has been placed in charge of the new production department of General Drilling Co., with headquarters in Chickasha, Okla.

H. B. Sauve, former chief geophysicist in Standard-Vacuum Oil Co.'s exploration department in New York, has been elected to the board of directors of Vacuum Oil Co., Pty., Ltd., Melbourne, Australia. He also has been appointed general manager of Frome-Broken Hill Co., Pty., Ltd., an exploration company under Vacuum's technical management. Sauve has moved to Melbourne to make his headquarters.

Thomas Davis Jones, geologist for Magnolia Petroleum Co., has been transferred from Houston to Oklahoma City.

Robert E. Landon, division geologist at Salt Lake City for General Petroleum Corp., has been transferred to Denver, where he will open an office for the firm.

A. Jacobsen, president of Amerada Petroleum Corp., has been selected to receive an honorary doctor of science degree from the University of North Dakota, Grand Forks, at commencement June 5.

Harold E. Berg has been appointed manager of production and **Arthur M. Mouser** has been made division petro-

H. E. BERG

A. M. MOUSER

leum engineer and supervisor of secondary recovery for Tide Water Associated Oil Co.'s central division in Tulsa. Berg joined Tide Water in 1937 and since August 1950 has been division production superintendent for Kansas, Oklahoma, and North Central Texas. Mouser has been with the firm since 1944 and in 1951 became production superintendent for Illinois and Indiana. Operations in western Pennsylvania were added to his area last August.

Bob Brinkerhoff has opened an engineering consulting office in Houston. During the past 2½ years he has been with Petroleum Management Co. and Livingston Drilling & Well Service, Inc., as consulting engineer and production superintendent. Prior to joining Petroleum Management, he was a field engineer for American Republics Corp.

Dan Nisley has been named division geologist and **Graham Fenner** has been named geophysical supervisor for Continental Oil Co.'s new exploration division at Ardmore, Okla. Both have been at Oklahoma City. The new division office will handle Conoco's exploration activities in southern Oklahoma. Previously the district office at Ardmore was part of the Oklahoma City di-

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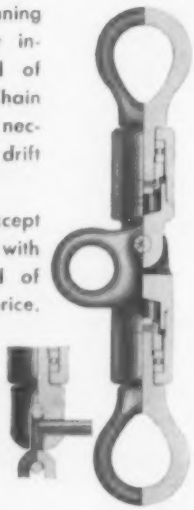

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PERSONALS

vision, which will continue to handle exploration activities in the rest of the state.

Albert Neunhoffer, head of the industrial-relations department of Creole Petroleum Corp. in Caracas, has retired following 26 years with Creole, 11 of which were in Caracas and 15 in Maracaibo. He is returning to San Antonio, Tex., his home in the United States.

C. Clark Fuller, Jr., has been promoted by Stanolind Oil & Gas Co. from reservoir engineer at Roswell to field engineer at Farmington, N. M.

James H. Manning has been appointed manager of exploration by British American Oil Co. He joined British American in 1952 and for the past year has been division geologist. His headquarters now are in Calgary, Alta.

Paul M. Fluckiger, Los Angeles, has been appointed special field service representative of the Pennsylvania Grade Crude Oil Association for the Pacific Coast area, succeeding **C. R. Wheeler,** Glendale.

R. B. Gustafson, Jr., has been transferred from Taylor Oil & Gas Co.'s office at Corpus Christi to Lafayette, La., as district geologist and manager, under the supervision of **Cecil D. Robinson,** division geologist for Taylor's Gulf Coast division. The firm is in a joint venture with Delhi Oil Corp. in South Louisiana and adjacent areas.

K. J. Reid has been made district geologist for Stanolind Oil & Gas Co.'s Oklahoma City district, succeeding **E. L. Selk,** who has been made senior staff geologist in the firm's division office in Oklahoma City. **W. F. Bunker** has been advanced from an area geologist in the district office to replace Reid as assistant Oklahoma City district geologist.

Howard N. Wiest, chief gas dispatcher for Michigan Wisconsin Pipe Line Co., has retired after 31 years with the American Natural Gas Co. system. Wiest joined Michigan Wisconsin as chief gas dispatcher when the firm began operations in November 1949.

Richard R. McLeod, geologist for Gulf Oil Corp., has been transferred from Shreveport to Tallahassee, Fla.

H. A. Jones has been placed in charge of the new exploration offices recently opened in Denver by Malco Refineries, Inc., Roswell, N. M.

BOB HULSEY

Bob T. H. Hulsey has been appointed a second vice president in the petroleum department of Chase National Bank of New York, and **Harold D. Hammar** and **Gilbert H. La Piere** have been named official petroleum engineers of the bank. Hulsey joined the Chase organization in 1949 after working for Standard Oil Co. of Texas. Hammar and La Piere have been with Chase since 1951 and 1952, respectively.

V. K. Michael, with Ohio Oil Co. for about 20 years, has resigned to become an independent operator at Vincennes, Ind.

James C. Saks has been appointed assistant to **N. E. Tanner,** president of Trans-Canada Pipe Lines, Ltd. He has been with Trans-Continental Resources, Ltd., Stevenson & Kellog, Ltd., and was general manager of Atkins & Durbrow, Ltd., all in Vancouver, B. C. For the last year he was publisher of the Western Oil Examiner in Calgary, Alta.

James W. Bateman, Houston, technical assistant to the manager of Continental Oil Co.'s manufacturing department, has been selected to receive a 1954-55 Sloan Fellowship at the Massachusetts Institute of Technology, Cambridge, Mass. His course will extend a year, starting in June. The Sloan Fellowship Program for Executive Development was founded in 1938 by the Alfred B. Sloan Foundation, Inc., to train promising young technical executives in the broader phases of industrial management and to prepare them for future positions of business leadership. Bateman joined Conoco in Houston in 1952 as technical assistant to the manager of manufacturing and has been responsible for improvements in Conoco refinery processes, economic evaluations and various technical phases of manufacturing operations.

H. K. Dolan, geologist for Stanolind Oil & Gas Co., has been transferred from Casper, Wyo., to Billings, Mont.

R. A. (Dick) Wise, Sullivan, Ind., has resigned as superintendent for F. B. Cline to become general superintendent of drilling and production for Pico Oil, Inc., Indianapolis.

Ted Anthony, dope foreman formerly at Missoula, Mont., for Eastern Pipeline Contractors, has joined Williams Brothers Overseas Co., Ltd., at Bogota, Colombia.

Charles E. Dimit has resigned as vice president of Creslenn Oil Co., Dallas. He plans to become an independent operator in the Rocky Mountain area with offices in Denver.

Dell C. Wade has been promoted by Crown Central Petroleum Corp. from petroleum engineer at Houston to division production superintendent at Abilene, Tex.

Ardis Martin, formerly production superintendent at Jacksboro, Tex., for Wrightsman Oil Co., has been made production superintendent at Bowie, Tex., for Jack Grace Production Co.

Robert L. Smith has been transferred by Shell Oil Co. from Donaldsonville, La., where he was exploitation engineer, to New Orleans as production geologist.

Merle A. Beeson has been promoted from assistant engineer for Magnolia Petroleum Co. at Norris City, Ill., to assistant production foreman for Colombian Petroleum Co., at Cucuta, Colombia.

Chairmen of six major technical committees of the National Association of Corrosion Engineers have been named. They are: **E. C. Greco,** United Gas Corp., Shreveport, T-1 on Corrosion of Oil and Gas Well Equipment; **W. H. Stewart,** Sun Pipe Line Co., Beaumont, T-2 on Pipeline Corrosion; **F. M. Watkins,** Sinclair Research Laboratories, Harvey, Ill., T-3 on General Corrosion; **F. E. Kulman,** Consolidated Edison Co. of New York, T-4 on Utilities; **Paul J. Gegner,** Columbia-Southern Chemical Corp., Bar-

PERSONALS

berton, Ohio, T-5 on Corrosion Problems in the Process Industries; and **A. J. Liebman,** Pitmar Centrifugal Machine Corp., Pittsburgh, T-6 on Protective Coatings.

Harold J. Reedy has been promoted by British-American Oil Producing Co. from senior geologist to district geologist. **J. C. Barcklow** also has been promoted from junior geologist to geologist.

Gordon S. Knox has resigned from the geological staff of Phillips Petroleum Co. in Midland, Tex., to join Grover & McCurdy, independent oil firm at Midland, as a partner. The company's new name is Grover, McCurdy & Knox. Knox had been with Phillips for 8 years since receiving a degree in geology from the University of Oklahoma.

C. E. LEACH

L. K. LANCASTER

Claude E. Leach has been transferred by Tide Water Associated Oil Co. from Houston to Tulsa as manager of exploration of the new central division. Since July 1953 he has been manager of the geological department of the Mid-Continent division, now divided into the central and southern divisions. **L. K. Lancaster** also has been moved from Houston, where he had been assistant chief geologist since March 1953, to Tulsa as central division geologist.

I. L. Coffman, formerly chief engineer of Phillips Petroleum Co.'s refining department, has been transferred to McGregor, Tex., as manager of engineering at Air Force plant No. 66, operated by the rocket fuels division of the company's research and development department. **L. G. Molique,** formerly assistant superintendent of Phillips Kansas City, Kans., refinery, has replaced Coffman at Bartlesville, Okla. Phillips has been contractor - operator since 1951 of the plant at McGregor which is engaged in large-scale development leading to manufacture of solid fuels for rockets of the jet-assist take-off type.

Elmer R. Cheadle, oil dispatcher for Service Pipe Line Co., Tulsa, has retired after 36 years with the firm.

Fred A. Hildenbrand, geologist with Atlantic Refining Co., has been transferred from Corpus Christi to Billings, Mont.

F. M. Jayne has been elected a vice president of Standard Oil Co. of California. He joined the firm in 1934 and has been secretary of the executive committee since 1949.

H. O. Cameron, Toledo, has been appointed assistant to Sun Oil Co.'s vice president in charge of production. **George W. Myers,** formerly assistant manager of the Michigan production division, has been advanced to manager, replacing Cameron. **F. H. Latimer** has been made assistant division manager.

A. J. Morris has been elected a vice president of Crown Central Pipe Line Co. He also will be appointed a vice president of Crown Central Petroleum Corp.'s two other wholly owned subsidiaries, Crown Central Pipe Line & Transportation Corp. and Crown-Rancho Pipe Line Corp. Morris will continue as manager of supply and transportation for the Crown companies in active charge of both crude-oil purchasing and pipeline activities.

C. F. Gates, General Petroleum Corp., Los Angeles, has been elected chairman of the Pacific Coast district of the American Petroleum Institute's Division of Production. He succeeds **Milan G. Arthur,** Union Oil Co. of California, Los Angeles. Vice chairmen elected at the group's spring meeting recently in Los Angeles include: **E. M. Benson, Jr.,** Richtfield Oil Corp., Long Beach, for Los Angeles basin; **Hugh C. Mays,** Crescent Petroleum Co., Maricopa, for San Joaquin Valley; **John Van Riper,** Continental Oil Co., Ventura, for coastal; and **Jack Lemley,** Standard Oil Co. of California, for Coalinga-Kettleman.

Milan Arthur, Union Oil Co. of California, and **E. O. Peschke,** Baker Oil Tools, Inc., have been presented "citations for service" in recognition of their outstanding contributions to the Pacific Coast district of the American Petroleum Institute's Division of Production. Arthur was selected for his services as program chairman in 1952, general chairman in 1953, and district chairman, 1953-54. Peschke was chosen for his services as general arrangements chairman in 1954. **John G. Pew,** vice president of Sun Oil Co., Philadelphia, and A.P.I. vice president for production, made the presentation at the district's spring meeting in Los Angeles.

G. L. Macpherson has been elected to the board of directors of Imperial Oil, Ltd., raising the membership to 10. Since 1949 he has been general manager of the manufacturing department.

Howard Halff, gas engineer for The Texas Co., has been transferred from the West Texas division at Fort Worth to the South Texas division in Houston.

DEATHS

Altis S. Hopkins, former president of Standard Oil Co. (Kansas), died recently in Neodesha, Kans. He began at the Neodesha refinery when construction started in 1897 and continued there until his retirement in 1932.

Norman Morrow, 83, senior member of Morrow & Co., Howard, Kans., died recently in Moline, Kans. He was a veteran drilling contractor and operator in Pennsylvania, West Virginia, Illinois, and Kansas.

Harold R. Pauley, 44, president of Stancal Asphalt & Bitumuls Co. and an independent operator, died unexpectedly near Santa Barbara, Calif., recently. He was former president of Petrol Corp., Los Angeles, and a brother of Edwin W. Pauley.

Clifford A. Thomas, 49, former vice president and secretary of Barber Oil Corp., died recently in Bronxville, N. Y.

Edgar F. Schaefer, 58, president of Gardner-Denver Co., died recently in Quincy, Ill. He had been with the firm 35 years.

Joseph S. Rose, Sr., 64, independent operator, died recently in Denver. He was active in the East Texas boom, Mississippi, and the Tri-State area. Most recently he had been active in the Rocky Mountain area.

Big, wide doors and post-free interior make it easy to drive trucks in and out, or to maneuver them inside. This Butler steel building is used for cleaning and preparing jets for shooting oil wells.

Sturdy rigid-steel frame has the strength to *entirely* support this bridge-type crane which is used to lift heavy jets. Big, weather-sealed windows let in plenty of light for closest work.

Field office with-a-future, come what may. This 20' x 40' x 10' Butler steel building could be an employees' change room, laboratory or tool room. It even could be economically moved to another site.

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By combining the Butler steel structure and metal covering with wood, masonry and glass, you can get eye-catching individuality even on a modest budget. The branch oil field office and warehouse pictured above is a typical example.

Butler rigid-frame construction makes every foot of floor space usable. It is strong enough to support bridge-type cranes and other labor-saving devices. You have a choice of widths, lengths and heights, in single or multiple buildings, to suit practically any oil field need.

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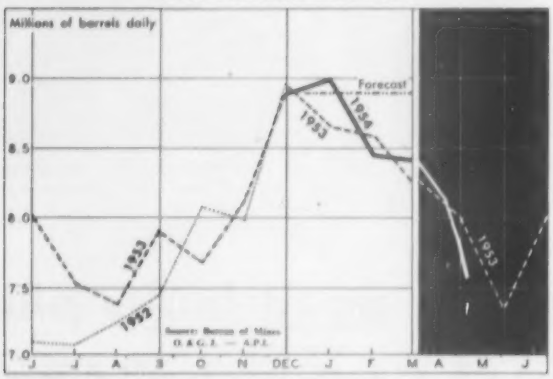
Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,427,000	DOWN	187,825	UP	98,150
Crude stocks	274,003,000	UP	4,356,000	DOWN	5,566,000
Completions	1,005	DOWN	7	DOWN	24
Refinery runs	6,764,000	UP	89,000	DOWN	101,000
Gasoline stocks	175,874,000	DOWN	1,184,000	UP	19,849,000
Four-product stocks	304,691,000	UP	2,401,000	UP	26,110,000
Total imports	1,070,400	UP	291,800	DOWN	82,900

TOTAL DEMAND—ALL OILS



Part of Crude-Stock Increases Dates Back to Previous Weeks

CRUDE stocks did not actually increase 4,356,000 bbl. for the week ended May 1. The weekly crude-stock report by the Bureau of Mines indicated the increase, but a look at all production and run data will show that part of the gain should be credited to some of the earlier weeks of the month.

Production of crude and lease condensate for the week ended May 1 averaged about 6,615,000 bbl. daily. Crude imports were down to 495,000 bbl. daily for a total average supply for the week of 7,110,000 bbl. daily.

Refinery runs for the week were reported at 6,675,000 bbl. daily by A.P.I. The volume of crude exported, transferred to products, or unaccounted for averaged about 60,000 bbl. daily for a total of 6,735,000 bbl. daily. The difference between supply and demand of 375,000 bbl. daily accounts for only 2,600,000 bbl. of the reported increase.

For the week ended April 17, demand for crude was in balance with supply, indicating very little change in crude stocks. However, the bureau's report for the week showed a drop in crude stocks of a little more than 1,000,000 bbl. Some of this error was corrected by higher stock levels reported to the bureau for the last week of the month.

Changes since first of year . . . Despite the large reported increase in crude stocks for the last week of April, the total is still less than at the first of the year. The weekly crude stock report was about 5,000,000 bbl. too low at the end of 1953. Crude inventories on December 31, reported in the bureau's Monthly Petroleum Statement, totaled 276,676,000 bbl.

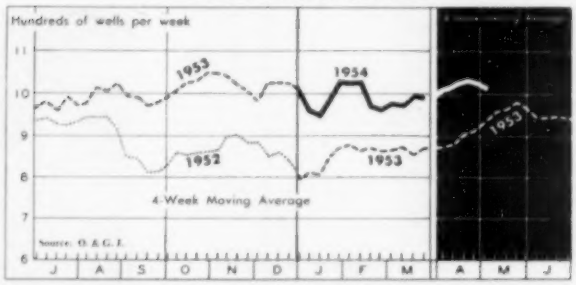
Also, since the weekly report of crude stocks was about 3,000,000 bbl. too low at the end of March and since supply and demand were about in balance for the first week of that month, it is possible that stocks did not reach the low level of 261,900,000 bbl. reported for March 6.

Crude stocks probably have climbed about 8,000,000 bbl. in the past 2 months rather than the 12,000,000 bbl. indicated by the weekly crude-stock reports.

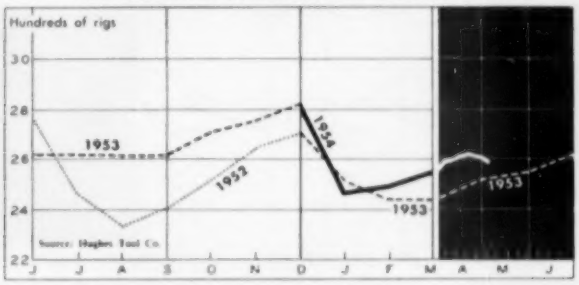
Small stock change in May . . . Refinery runs for May were forecast at 6,940,000 bbl. daily by the Bureau of Mines, but the publicity that has been given to high gasoline stocks may keep runs slightly below that level. If runs average about 6,920,000 bbl. daily this month, crude exports, transfers, and losses will bring total crude use up to about 6,970,000 bbl. daily. Crude production and imports of crude will be down to about the level of demand for practically no change in crude stocks for the month.

Market trends . . . Colder weather in northern states increased movement of distillate, but some material is reported available in Group 3 at under-the-market prices. Demand for natural gasoline has improved on the Gulf Coast but not enough to change quoted prices.

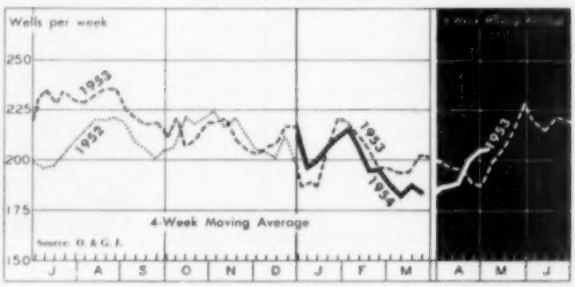
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS

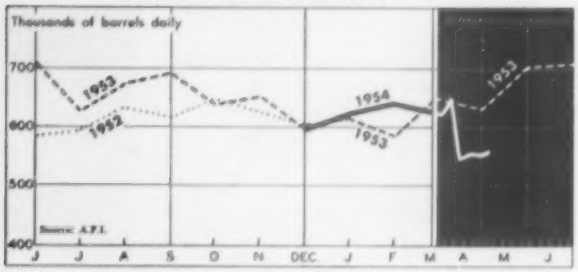
Area—	5-10-54	Change from 5-3-54	Change from 5-11-53
Gulf Coast	561	— 5	—48
N. and W. Texas-New Mexico	813	8	— 7
Arkansas-N. Louisiana-E. Texas	173	—18	52
Oklahoma	352	— 4	3
Kansas-S. Nebraska	164	1	— 9
Illinois-Eastern	130	4	19
Rocky Mountain	248	— 6	22
Pacific Coast	142	2	—25
Total United States	2,583	—18	7
Western Canada	112	—15	—20

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 8, 1954

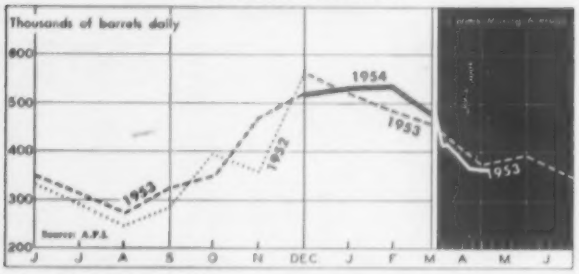
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1954	Cum. 1953	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1954: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	2	0	0	2	11,185	42	48	0	0	0	2	2	2	0	1	35	38
Arkansas	10	5	0	5	46,628	244	163	3	0	0	2	5	11	0	2	37	50
California	46	37	1	8	206,490	874	912	2	0	0	8	10	29	1	6	185	221
Colorado	40	12	1	27	223,492	435	173	0	0	0	21	21	13	0	0	159	172
Illinois	69	41	0	28	169,074	940	586	0	0	0	8	8	2	0	0	154	156
Indiana	14	4	0	10	24,485	273	417	1	0	0	2	3	4	0	0	64	68
Kansas	88	35	13	*40	292,416	1,561	1,761	2	0	0	12	14	27	0	7	205	239
Kentucky	20	12	0	8	41,523	382	357	1	0	0	0	1	8	0	0	40	48
Louisiana	57	44	4	9	253,520	1,147	914	1	0	0	2	3	36	20	12	92	160
North	38	31	4	3	90,400	626	376	0	0	0	0	0	5	0	3	35	43
South	19	13	0	6	163,120	521	538	1	0	0	2	3	31	20	9	57	117
Michigan	9	4	0	5	23,680	196	185	0	0	0	4	4	4	0	0	84	88
Mississippi	9	3	1	5	68,844	135	123	0	0	0	4	4	2	0	0	49	51
Montana	7	3	0	4	35,553	101	135	0	0	0	1	1	1	0	0	28	29
Nebraska	5	2	1	2	25,630	118	98	0	0	0	2	2	8	0	0	35	43
New Mexico	11	7	3	1	68,655	390	465	0	0	0	0	0	7	0	3	50	60
North Dakota	7	2	0	5	50,899	85	84	0	0	0	5	5	3	0	0	29	32
Ohio	24	13	1	*10	41,874	392	354	1	0	0	0	1	1	0	2	5	8
Oklahoma	183	124	4	†55	637,408	3,319	2,484	1	0	1	15	17	43	2	9	219	273
Pennsylvania-New York	48	24	4	‡20	83,700	855	817	0	0	0	0	0	0	0	3	10	13
Texas	318	177	16	125	1,481,826	6,316	6,029	10	0	5	78	93	250	27	59	1,435	1,771
Southwest (1 & 4)	45	22	1	22	175,485	917	967	2	0	0	16	18	26	16	14	254	310
Gulf Coast (2 & 3)	50	26	3	21	321,466	969	886	1	0	1	16	18	27	9	16	238	290
East (5 & 6)	20	6	5	9	98,603	311	298	0	0	0	7	7	6	0	6	85	97
North Central (7-B & 9)	103	58	1	44	341,836	2,361	2,227	5	0	0	24	29	121	2	8	585	716
West (7-C & 8)	86	56	4	26	498,967	1,436	1,336	2	0	3	13	18	70	0	10	247	327
Panhandle (10)	14	9	2	3	45,469	322	315	0	0	1	2	3	0	0	5	26	31
Utah	0	0	0	0	0	22	25	0	0	0	0	0	2	0	0	13	15
West Virginia	13	1	10	2	33,599	195	197	0	0	2	0	2	0	0	10	5	15
Wyoming	25	18	0	7	139,915	521	207	1	0	0	4	5	18	0	3	68	89
Miscellaneous	0	0	0	0	0	76	16	0	0	0	0	0	1	0	0	10	11
Total United States	**1,005**	568	59	378	3,960,396	18,619	16,550	23	0	8	170	**201**	472	50	117	3,011	3,650
Total previous week	1,012	579	54	379	3,999,513			21	2	7	177	207	449	50	109	2,841	3,449
Total May 9, 1953	981	503	71	407	3,879,262			23	2	14	193	232	479	34	133	3,038	3,684

Service wells included: *2, †5, ‡18.

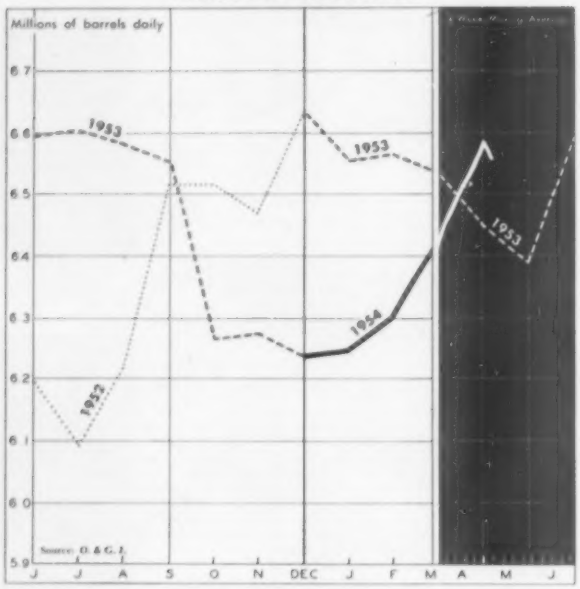
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

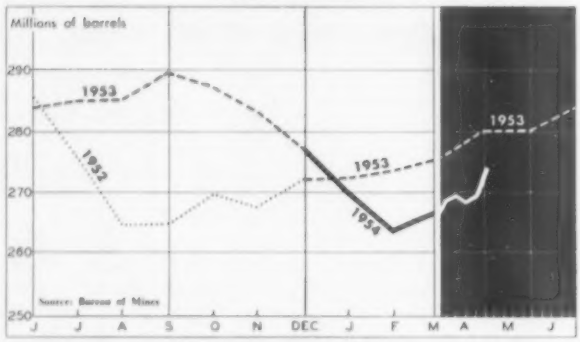


DAILY AVERAGE PRODUCTION FOR WEEK

	May 8			May 1
	Crude oil	Lease condensate	Total	total
Alabama	4,700		4,700	4,800
Arkansas	76,550	550	77,100	77,600
California	989,700		989,700	987,100
Colorado	125,200		125,200	126,200
Eastern	54,500		54,500	54,500
Florida	1,650		1,650	1,525
Illinois	187,000		187,000	183,600
Indiana	31,700		31,700	31,100
Kansas	321,500		321,500	336,700
Kentucky	35,700		35,700	35,400
Louisiana	668,650	44,300	712,950	726,150
North	108,650	3,800	112,450	112,650
South	560,000	40,500	600,500	613,500
Michigan	36,200		36,200	34,500
Mississippi	88,750	3,300	92,050	91,700
Montana	32,100		32,100	32,900
Nebraska	20,400		20,400	20,100
New Mexico	204,100	1,600	205,700	208,200
North Dakota	14,700		14,700	15,100
Oklahoma	541,400		541,400	547,300
Texas	2,640,000	50,550	2,690,550	2,851,250
Dist. 1	41,500	425	41,925	41,925
Dist. 2	139,000	7,200	146,200	155,700
Dist. 3	416,000	24,250	440,250	457,250
Dist. 4	240,000	6,000	246,000	262,400
Dist. 5	44,000	450	44,450	48,450
Dist. 6	109,000	5,200	114,200	124,300
East Texas field	229,500		229,500	248,800
Dist. 7-B	119,000	50	119,050	139,050
Dist. 7-C	178,000	4,750	182,750	188,750
Dist. 8	856,000	1,700	857,700	903,500
Dist. 9	188,000	500	188,500	194,600
Dist. 10	80,000	25	80,025	86,525
Utah	5,400		5,400	5,400
Wyoming	246,800		246,800	243,700
Total U. S.	6,326,700	100,300	**6,427,000**	6,614,825
Change from previous week, down			**187,825**	
Canada	168,700		168,700	186,925
Total U. S. production January 1-May 8				822,385,750 bbl.
Same period last year (crude plus cond.)				*833,782,995 bbl.

*Includes 12,005,625 bbl. condensate.

CRUDE-OIL STOCKS



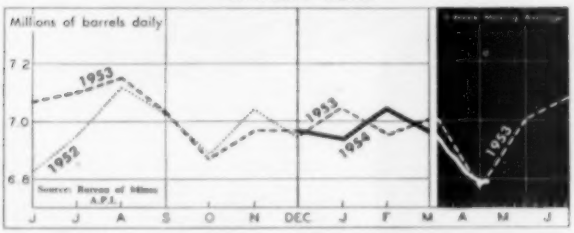
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

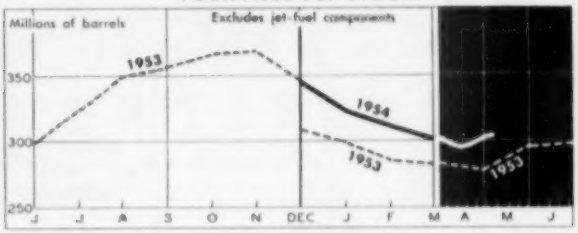
	May 1, '54	Apr. 24, '54	May 2, '53
Pennsylvania Grade	3,150	3,005	2,527
Other Appalachian	1,829	1,716	1,961
Illinois, Indiana, Michigan	12,455	12,254	11,601
Kansas	9,781	9,557	10,942
Oklahoma	27,004	26,471	27,842
Arkansas	3,555	3,497	3,036
Louisiana	16,336	15,717	15,839
North	2,506	2,481	2,687
Gulf	13,830	13,236	13,152
Mississippi	3,287	3,430	4,055
New Mexico	7,598	7,655	7,469
Texas	126,645	123,034	136,537
East Texas proper	11,677	10,808	11,772
West Texas	54,512	54,130	64,068
Texas Gulf	26,460	25,732	26,396
Other Texas	33,996	32,364	34,301
Wyoming	14,229	14,088	13,687
Other Rocky Mountain	3,777	3,786	2,694
California	33,898	34,113	33,255
Foreign	†10,459	11,324	8,124
Total	274,003	269,647	279,569

*Bureau of Mines. †Includes 2,269,000 bbl. in California.

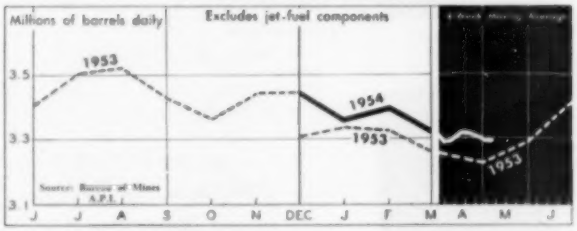
REFINERY RUNS



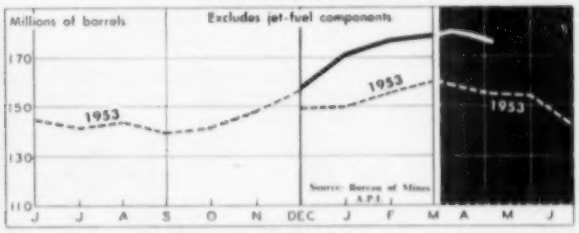
FOUR-PRODUCT STOCKS



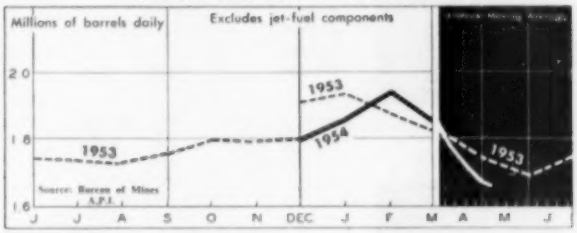
GASOLINE PRODUCTION



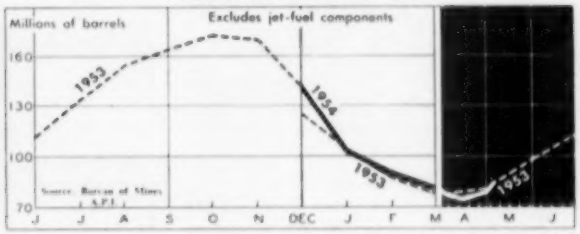
GASOLINE STOCKS



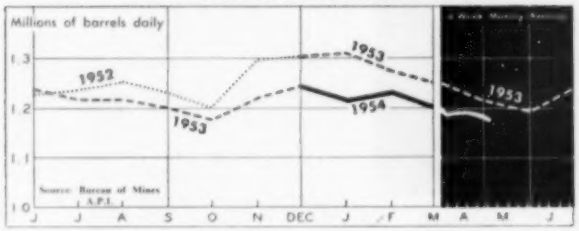
MIDDLE-DISTILLATE PRODUCTION



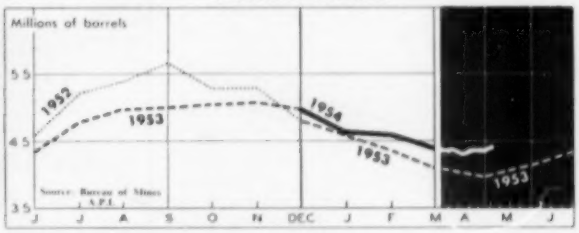
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, MAY 8

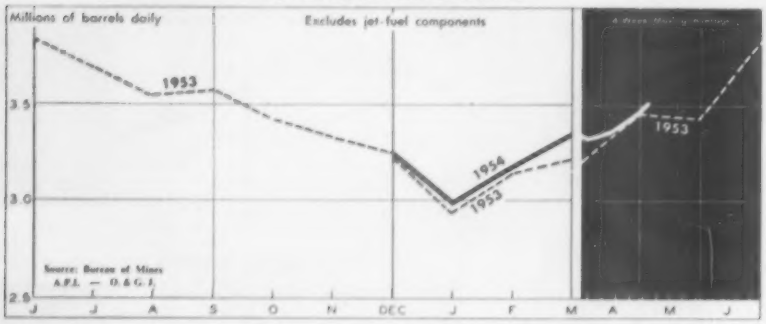
(Excludes all jet-fuel components)

(Thousands of barrels)

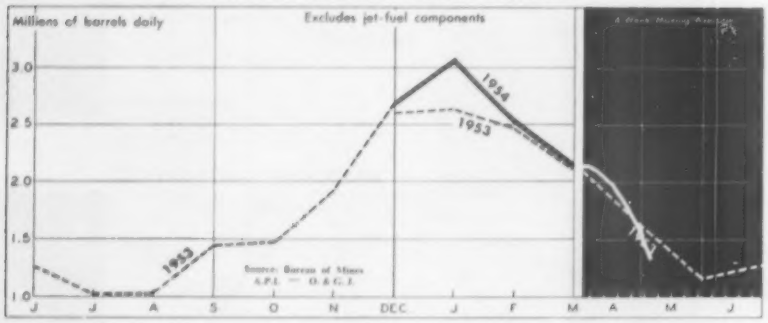
District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1953 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,000	399.9	19.2	226.3	207.0	36,405	8,322	20,645	8,748	1,939	413.9	35.6	239.5	223.1
Appalachian:														
District 1	89	37.0	2.7	15.9	4.3	4,307	405	1,126	541	103	39.7	4.9	16.2	14.0
District 2	94	47.0	9.1	14.3	9.8	2,645	339	681	403	95	48.2	3.0	11.3	14.3
Ind., Ill., Ky.	1,285	654.7	70.4	227.1	164.0	39,483	4,311	10,453	4,270	1,229	630.6	68.5	199.1	156.1
Okla., Kans., Mo.	596	327.4	10.4	135.0	39.5	19,301	1,085	7,324	1,267	571	309.1	15.4	128.1	48.9
Inland Texas	253	182.3	15.4	33.3	32.6	7,385	352	1,108	1,344	263	169.5	15.4	41.9	34.4
Texas Gulf Coast	1,611	773.6	95.7	335.7	241.3	23,071	2,505	6,818	4,104	1,707	799.3	100.4	390.2	241.3
La. Gulf Coast	501	259.0	25.7	152.1	36.6	8,804	1,788	3,004	1,178	570	270.1	42.2	133.3	52.8
N. La. and Ark.	89	35.7	9.2	20.3	6.3	4,041	599	853	179	86	32.1	7.9	18.5	7.2
Rocky Mountain:														
New Mexico	18	10.4	1.0	2.3	2.6	184		54	43	17	10.9	0.5	2.1	3.4
Other Rocky Mtn.	229	114.4	3.3	48.4	34.6	8,283	162	1,903	862	228	111.8	3.9	52.4	42.3
California	999	395.7	5.3	154.6	366.4	21,965	342	9,970	21,729	1,084	461.6	5.8	154.6	359.6
May 8, 1954	6,764	3,237.1	267.4	1,365.3	1,145.0	175,874	20,210	63,939	44,668	7,002	3,296.0	303.5	1,387.2	1,197.4
May 1, 1954	6,675	3,223.8	314.1	1,295.3	1,131.1	177,058	19,680	61,405	44,147					
May 9, 1953	6,865	3,222.6	314.4	1,339.6	1,253.1	156,025	19,765	62,721	40,070					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

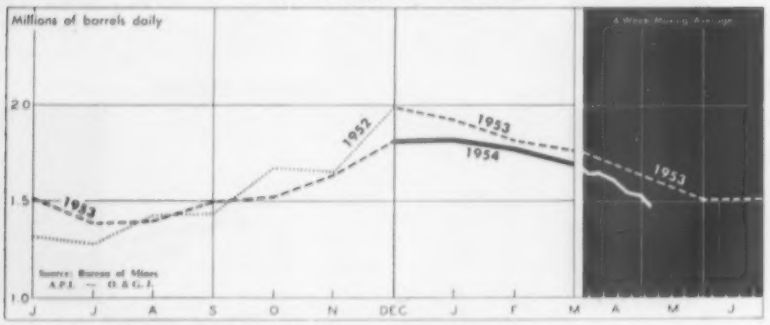
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of May 12, 1954. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.75-11	11.5-12.25	10.25-10.5
Premium gasoline	11.75-12	13.25-14	11.5-12.25
42-44 w.w. kerosine	9.125-9.375	9.95-10.2	9-9.25
No. 2 straw fuel oil	8.25-8.375	8.95-9.2	8-8.25
No. 6 residual	$1.00-1.20	$2.20-2.40	$1.85-1.95

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	4.5	4.0	4.25
Grade 18-55	5.4	4.9	5.15

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• Colder weather in the northern states for the first week of May resulted in increased demand for distillate fuels. Supplies were short at some pipeline terminals but plentiful at Mid-Continent refineries. Some material is available at subnormal prices.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 5-8-54	3,291	3,521
February 1954	3,365	3,182
January 1954	3,354	2,985
May 1953	3,297	3,456
Middle distillate:		
Four weeks ended 5-8-54	1,652	1,352
February 1954	1,957	2,417
January 1954	1,857	3,076
May 1953	1,691	1,171
Residual fuel:		
Four weeks ended 5-8-54	1,170	1,480
February 1954	1,241	1,753
January 1954	1,271	1,831
May 1953	1,197	1,510

CRUDE PRICES
GRAVITY SCHEDULE

	Signal Hill, Calif.*	Okla-homa, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87			
15-15.9	1.93			
16-16.9	1.99			
17-17.9	2.05			
18-18.9	2.11			
19-19.9	2.18			
20-20.9	2.24	$2.50		$2.37
21-21.9	2.30	2.52		2.39
22-22.9	2.37	2.54		2.41
23-23.9	2.45	2.56		2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9		2.76	3.09	2.63
34-34.9		2.78	3.11	2.65
35-35.9		2.80	3.13	2.67
36-36.9		2.82	3.15	2.69
37-37.9		2.84	3.17	2.71
38-38.9		2.86	3.19	2.73
39-39.9		2.88	3.21	2.75
40 and above		2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Includes New Mexico Permian.

Prices east of California effective June 15, 1953. California prices effective February 16, 1953. Pennsylvania Grade prices effective January 1, 1954.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.76
Middle District	3.70
Southwest Pennsylvania	3.31
West Virginia	3.25
Ohio	3.24
Illinois Basin	3.02

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FOR SALE EQUIPMENT

FOR SALE: ENGINE—165 Hp Climax Model R6I, maximum continuous Hp rating 126. Herndon Drilling Company, 421 Mayo Building, Tulsa, Phone 4-9700.

FOR SALE: 12,000′ 4″ o.d. seamless line pipe. 40′ random lengths. Clean inside and out. Beveled ready to lay 35c f.o.b. our yard. M. J. Regan Pipe Co., Coffeyville, Kans.

PIPE. New seamless J55 mill end 5½″ and 7″ from Pueblo mill. Get our low prices. Pressey & Son, Pueblo, Colorado.

SALES and rentals of cable drilling and fishing tools, casing and equipment, from the Southwest's largest stock of used cable tools and oil field supplies. Degen Pipe and Supply Co., Tulsa, Oklahoma.

Gaso Duplex 4½″ x 6″ Power Pumps with Chrysler C-36 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

1—250 Bethlehem Draw Works in excellent condition, equipped with Tex-Rope Compound and 2—JL 1335 Buda Engines.

1—350 Bethlehem Draw Works in excellent condition, equipped with Unit Compound and 2—NK "Waukesha" Engines.

5000 Feet—Used 4½″ Drill Pipe.
1—G-6 National Swivel.

To see contact F. A. Cowsar or Leonard Burt. Phone #40, Davenport, Oklahoma.

FOR SALE IN OHIO

I-R Gas Engine Driven Angle Type Gas Compressors Model 62 KVG-2 600 H.P. 350 RPM. Low pressure cylinder 30″ X 14″ high pressure cylinder 14½″-X 14″ discharge pressure of second stage 155 psig.

ALSO

1000 K.W. G.E. Condensing Turbine—generator set with direct connected exciter and surface air cooler.

THE STANDARD OIL CO.

1401 Midland Blvd.
Cleveland 15, Ohio
R. L. CHARLES OR W. J. PENCE

FOR SALE EQUIPMENT

MODEL H CARDWELL Servicing Unit. Truck mounted with mast. Fully equipped. Box No. 1 or Phone 153, Canton, Kansas.

1—1250 KVA Turbo-Generator, 1—730 KVA Turbo-Generator; both Steam Turbines 150 P.S.I.; Condenser for both Generators; 2 Air Ejectors; Oil Filter for both units and pump. This material was used to furnish power for city of 50,000 people. Can be inspected in Houston. For particulars, wire, write or call Bogle Pipe & Steel Company, 102 Heights Blvd., VIctor 6333, Houston.

FOR SALE: New Emsco G-42 Draw works complete with Caterpillar diesel engines, Gardner pumps; with or without 129′ Emsco mast or 96′ Ideco or drill pipe and drill collars. Priced at less than 50c on the dollar. Phone, wire or write Dunlap & Graham, Inc., 2456 Cerritos Avenue, Long Beach, California.

COMPLETE ROTARY RIG, Unit 34 Hoist, 94′ Lee C. Moore Mast, 4′ Substructure, 7¼ X 12 Pump, Shale Shaker, 4000′ of 4½″ extra good Drill Pipe, all necessary hand tools, Subs, 5″, 7″ and 10¾″ Casing Tools. Write or call for inventory. Seran Drilling Company, Phone 450 or 657, Okemah, Oklahoma.

FRANKS ETS-5000—Single Drum Hoist Less Engine. Sales Price—$1,500. General Appearance—Good. Unit complete with Franks Power Take-Off; Mounted on Steel and Wood Truck Bed. Location of Unit—Winfield, Kansas. Contact Cardwell, Wichita.

FOR SALE

12 NEW STERLING ENGINES
VIKING NO. II
8 cylinder, 600 hp., 1200 r.p.m.

Will sell crated for export F.O.B. dock, San Francisco.

S. & W. Machinery & Supply Company
Pier 3
San Francisco, California
YUkon 6-6853

HUMBLE TYPE

1¼″ PRESSURE and TEMPERATURE RECORDERS
2¼″ DRILL-STEM PRESSURE RECORDERS
OIL FIELD RESERVOIR ANALYSIS EQUIPMENT

ENGINEERING PRODUCTS INC.

(Successors to Engineering Laboratories, Inc. BHP Division)
600 E. 4th St. Phone 2-7223
Tulsa 3, Oklahoma

FOR SALE EQUIPMENT

FOR SALE: At Madison, Kansas, 4—50 hp. and 1—60 hp. Superior, 4 cycle, commercial type horizontal, single cylinder, gas engines. Price $500.00 each. Also, 20′ and 24′ double eccentric steel bandwheel powers, $250.00 and $350.00 each. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

FOR SALE: At our Oklahoma City warehouse, a quantity of 9″ OD 40# used J-55 seamless steel casing, 8V thd. ST&C, unshopped $2.50 per ft., shopped $3.00 per ft. Also 9″ OD 46.10# LT&C ditto shopped $3.60 per ft. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

FRANKS MODEL 5000 Spudder—Serial No. 866. Sales Price—$7,500. Equipped with one Cummins HB1-600 Engine in good condition. Brake Rims in fair condition; Brake blocks—Good. General appearance—Good. Chains—Good. Basic Machine equipped with Spudding attachment, Skid and 65′ Double Leg Pipe Mast with 8⅝″ and 7″ Pipe Legs; 4-Sheave Crown of Wilson Manufacture. Price includes Mast Guy Lines. Location of Unit—Western Kansas. Contact Cardwell, Wichita.

WILSON ATLAS. Sales Price—$21,000.00. Equipped with two LI-600 Cummins Diesel Engines in good condition; includes pump drive, 12 PD groove sheave and V-belts. One American cathead and one plain spool cathead. Compound enclosed oil-bath. Includes one 1000 gal. fuel tank. Contact Cardwell, Houston.

WILSON GIANT—Serial No. 6383. Sales Price—$6,000. Equipped with Two Waukesha 145 GK Engines in good condition. General Appearance—Fair. Rig used for Work-Over. Price includes Kelco Spinning and Foster Breakout Catheads; Stromberg-McCreary Air Starters on Engines. Brakes circulating water-cooled; Manual Friction Clutches in Transmission; Others—Jaw Clutches. Rig has Slush Pump Drive and Rotary Drive. Location of Unit—Lake Charles, Louisiana. Contact Cardwell, Houston.

PIPE

8⅝″ O.D. .322 wall 28,000 ft.
12¾″ O.D. .375 wall 26,000 ft.
Reconditioned Line Pipe
18 foot R. L.

NEW ELECTRIC WELD REJECTS

7″ O.D.	.317 wall	200 feet
8⅝″ O.D.	.352 wall	500 feet
9⅝″ O.D.	.385 wall	2,000 feet
16″ O.D.	.375 wall	1,460 feet
20″ O.D.	.281 wall	1,300 feet
24″ O.D.	.281 wall	720 feet
24″ O.D.	.406 wall	920 feet
26″ O.D.	.281 wall	1,100 feet
26″ O.D.	.312 wall	820 feet
26″ O.D.	.500 wall	120 feet

All 40 foot lengths
Special Low Price
Write—Wire—Phone

SONKEN-GALAMBA CORPORATION

2nd and Riverview (X-148)
Kansas City 18, Kansas
ATwater 9305

FOR SALE EQUIPMENT

100,000 FEET Good Used 8" line pipe .322 wall, 28.55# lapweld, 8⅝ O.D. 1500 foot lots, F.O.B. location Illinois & Indiana. Peter Grimm, 119 Washington Avenue, Stamford, Conn.

NEW 12¾ SEAMLESS COUPLINGS $4.75 each. Edco Pipe & Supply, Box 151, Tulsa, or phone 4-5970.

FOR SALE—At our Arkansas City, Kansas, gasoline plant, 11—10' x 40' horiz. gasoline storage tanks, $850.00 each. Cities Service Oil Company, Patridge, Bartlesville, Oklahoma.

250,000 FT. 8⅝ o.d. pipe with collar and plain end. $1.00 per foot Oklahoma. Rogers & Lundquist, 620 Wright Building, Tulsa Okla. Phone 3-2072—5-5850.

SUPER ELECTRONIC Magnetometers, Scintillometers, Geiger Counters, Radioactive ores. Geoelectronic Scope Co., Route 11, Box 449, Fort Worth, Texas.

ROPER PUMP UNITS, (5) with 3 hp.—3 ph. 220/440 West. motor. Exc. cond. Harry J. Abrams, 331 Emerson St. N.W., Washington, D. C.

FOR SALE: One 18-trace set of reflection seismograph instruments, rack and panel mounted. Very reasonably priced. Texas Seismograph Company, Box 2069, Phone 3-1493, Wichita Falls, Texas.

CARDWELL MODEL S single drum works with WAKU Waukesha, American brakeout cathead, LeBus grooved bar, good condition. $5500. W. C. Fatjo. Phone 5-6137, Lafayette, Louisiana.

DRILLING equipment. New and used spudders, rotaries, tools. Everything for well drilling. Fishing tools rented. Pressey & Son, Pueblo, Colorado.

DEPTH AND TEMPERATURE machine. Built by government. Very good condition. Harry J. Abrams, 331 Emerson N.W., Washington 11, D. C.

FOR SALE: Model "K" Cardwell single drum well servicing unit, powered by 6-SRK Waukesha. With single pole telescoping mast, tubing line, 2", 2½" and 3" tubing tools mounted on Ford tandem truck; ½ ton Studebaker service pickup. Good running condition. For details, call or write Melco Drilling Company, Phone 2333, Box 1360, Seminole, Oklahoma.

WANT EQUIPMENT: Did you find the equipment you wish to purchase in this column? If not, use an "Equipment Wanted" classified advertisement to find it. It is available somewhere and Journal classified advertisements will find it. See box heading for classified rates, or write The Oil and Gas Journal.

Stop Tong Breakage!

ARMITE DRILL COLLAR & TOOL JOINT COMPOUND

ARMITE LABS., 6909 Broad St., Los Angeles 1, Calif.
Petro. Industries Consultants, C.A. Caracas, Venez.

FOR SALE

5—Cooper Type 80 Twin. Comp. Cyl. to suit.
2—Superior 100 H.P. 11x5½ Comp. Cyl.
1—Bessemer Type X Single.
Compressor Cylinders, Coopers, Clarks, and Bessemer various sizes and W.P. 20" stroke.
Clark 14" Stroke—29"-36-21-4½" 3¾" Bessemer—Clark—Cooper Bed Plates Flywheels—Shafts—Crossheads and Parts

W. S. SMITH
205 Thompson Bldg., Tulsa. 2-5473.

REAL ESTATE

SPACE IS NEEDED: A Journal display classified advertisement is the quickest way to rent or sell your real estate. In the present period of expansion oil industry firms urgently need the space you have available. If it isn't listed here, you may also find it by stating your needs in these pages. For classified rates see box heading or write The Oil and Gas Journal.

FOR SALE EQUIPMENT

SPECIAL LIQUIDATION
TOWERS AND COLUMNS

1—8' O.D. x 61' 6" SS, 15 trays, 50#, 300° F.
1—7' 6" O.D. x 55' 6" steel, 30 trays 45#, 300° F.
1—7' I.D. x 42' steel, 20 trays 40#, 150° F.
1—7' I.D. x 25'6" 10 trays, 50#, 250° F.
1—7' O.D. x 5' O.D. x 70' 4½" steel, 35 trays, 64#, 300° F.
1—6' I.D. x 64' steel, 35 trays, 55#, 300° F.
1—6' I.D. x 45' SS, 15 trays, 850#, 350° F.
1—5' O.D. x 61' 6" steel, 15 trays, 55#, 300° F.
1—4' O.D. x 110' 6" SS, 70 trays, 75#, 300° F.
1—4' O.D. x 72' SS, 40 trays, 55#, 300° F.
1—3' 6" I.D. x 63' steel, 35 trays, 55# 250° F.
1—2' 6" I.D. x 60' steel, 35 trays, 55# 300° F.
1—2' O.D. x 75' steel, 45 trays, 55#, 300° F.
1—2' I.D. x 71' steel, 50 trays, 70#, 300° F.

HEAT EXCHANGERS-CONDENSERS

2—1440 sq. ft. 304 S.S., 75# PSIG, 350° F.
3—1345 sq. ft. steel, 70# PSIG, 300° F.
1—1270 sq. ft. steel, 55# PSIG, 350° F.
2—1250 sq. ft. steel, 45# PSIG, 350° F.
2—1125 sq. ft. steel, 850# PSIG, 900° F.
2—1125 sq. ft. 304 S.S., 55# PSIG, 450° F.
1—750 sq. ft. steel, 60# PSIG, 350° F.
1—660 sq. ft. steel, 55# PSIG, 350° F.
1—400 sq. ft. 304 S.S., 75# PSIG, 350° F.
1—340 sq. ft. steel, 55# PSIG, 185° F.

BRILL EQUIPMENT COMPANY
4101 San Jacinto St., Houston 4, Texas, Justin 6032

EQUIPMENT WANTED

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

MATERIAL WANTED

One 13⅝" Shaffer Blowout Preventer, Type 39. One 10¾" Shaffer Blowout Preventer, Type 39.

MAKIN DRILLING COMPANY
P.O. Box 1628
Hobbs, New Mexico

HELP WANTED

ENGINEER with experience in field of corrosion to set up and maintain corrosion control program on Gulf Coast off-shore installations for major oil company. Location in Mid-Continent Region. Salary commensurate with experience. Please summarize educational and experience background in first letter. Box H-185, The Oil and Gas Journal, Tulsa, Oklahoma.

OLD ESTABLISHED DISTRIBUTOR of oil well supplies and oil well pumping equipment has opening for experienced sales engineer, age 35-45. The man who can qualify and has good contacts with the producing division of the oil industry can expect bright future and unusual earnings. References and complete information, which will be kept strictly confidential, must accompany application. Box H-200, The Oil and Gas Journal, Tulsa, Oklahoma.

FIELD SUPERINTENDENT: Successful independent producer has opening for Central Kansas district requiring supervision of 1,000 barrel daily production and substantial drilling. Promising future. State age and qualifications. Strictly confidential. P. O. Box 1160, Tulsa, Oklahoma.

RESEARCH CHEMIST
Challenging opportunity for a man with several years' industrial research experience on catalysts for petrochemicals. Require M.S. and/or Ph.D. degree. Send complete resume including expected salary. Address replies: Personnel Director, The Harshaw Chemical Co., Cleveland 6, Ohio.

GEOLOGIST
PETROLEUM ENGINEER
(Production, Reservoir)

Positions open in Arabia. Require suitable educational background and 3 to 5 years experience. One year contract. No family quarters. Excellent salary and benefits. Apply in writing, furnishing full description of experience and qualifications to:

AMERICAN INDEPENDENT OIL CO.
111 Sutter St., San Francisco

HELP WANTED

OIL INDUSTRY Employment Service. Tom Robinson, owner, 405 Tuloma Bldg., Tulsa, Oklahoma. For technical and trained oil industry personnel. Write for blank.

THE SUPERIOR OIL COMPANY has an opening in the Geophysical Department, starting as a computer. College degree in Geology, Geological or Petroleum Engineering required plus math through calculus and basic physics. No experience required. Send transcript, photo and letter of application to Personnel Department, The Superior Oil Company, Midland, Texas.

WANTED: Manufacturers representatives with good following calling on Oil Producers and Supply Stores to represent Manufacturer of the Hunter Flex-Seal oil well pump plunger and packing means for same. Wants Commission Sales Representatives for following territories: Kansas, Arkansas and North Louisiana, East Texas, West Texas, and California. Please give details concerning present Sales Coverage first letter. All replies confidential. W. H. Hunter Engineering Company, 150 Marlborough Dr., Pontiac 19, Michigan.

ENGINEERS, Executives, Technical Men Salaried positions—$3600 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 434 Frick Bldg., Pittsburgh 19, Pa.

PETROLEUM OR RESERVOIR ENGINEER

With minimum 3 years experience in development, production and oil and gas reservoir engineering on primary and secondary recovery problems. For New York office of major foreign producer.

MICROPALEONTOLOGIST

Preferably with an advanced degree and a minimum of 5 years' commercial or academic experience. To work in New York research laboratory. This position demands broad interests in Stratigraphy and Biofacies and the capacity to do independent work on projects assigned.

Salary for above positions dependent on experience and qualifications. Write giving full particulars regarding personal history and work experience. Please include telephone number.

RECRUITING SUPERVISOR
BOX OGJ-11

Arabian American Oil Company

505 Park Avenue
New York 22, N. Y.

SITUATIONS WANTED

PETROLEUM ENGINEER: 3½ years field engineer drilling and production Texas and Louisiana. Opportunity only consideration. Box H-195, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

RIGHTS OF WAY and Real Estate Supervisor, presently employed, twenty years' experience one company, University graduate, licensed broker and qualified to supervise or conduct negotiations and conveyancing. Box H-196, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM AND NATURAL GAS ENGINEER with many years of experience in making reports, appraisals, and tax studies for commercial, public utility, and income tax purposes, desires change in permanent position. Can furnish best of reference. Box H-198, The Oil and Gas Journal, Tulsa, Oklahoma.

FIELD SUPERINTENDENT or GENERAL MANAGER: B.S. degree, ten years varied experience in drilling and production. Presently employed as manager of consulting engineering and well operating company. Box H-197, The Oil and Gas Journal, Tulsa, Oklahoma.

DIESEL ENGINE maintenance Superintendent: 14 years experience with GM, Cummin, Caterpillar Superior, Budas. Rig Experience Also. 7 years supervisory experience. Pilot and A & E mechanic license. Experience in South America, speak Spanish. Age 32, married, two children. Foreign service will be considered. Box H-182, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SUPERINTENDENT or opportunity in refining organizations: Middle aged—Over 25 years experience in design, construction, modification, operation and maintenance of several complete refineries. Including solvent processing of Lubes and Waxes. Thoroughly experienced in organization and personnel development and manipulation. Especially qualified in analysis of operation and manipulating for maximum yields and realizations; at same time maintaining satisfactory product controls and production planning with marketing organization. Will consider subordinate position with opportunity . . . domestic or foreign location, or opportunity with consulting organization. Box H-181, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERINTENDENT: Graduate Engineer, Age 31, married, 7 years experience. Desire association with independent in Kansas. Am presently employed as production superintendent with independent in Oklahoma. Have had 6 years experience in Kansas production. Box H-180, The Oil and Gas Journal, Tulsa, Oklahoma.

PROFESSIONAL Engineer, over 20 years experience in all phases of the oil and gas business. Desires a change if the right connection can be made. Box H-192, The Oil and Gas Journal, Tulsa, Oklahoma.

B.S. IN CH. ENG. 1943, age 32, married, experience, 4 years in control laboratory, 7 years long range programing and economics of refinery operations, all with major oil companies in Latin America. Desire return to U. S. Box H-193, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES—Want to represent manufacturer of products and equipment used by the oil refining industry in states of Michigan and Ohio—many good contacts and years of experience this field. Box H-184, The Oil and Gas Journal, Tulsa, Oklahoma.

ATTENTION: Well established oil well drilling contractor desires to manage and supervise: Individuals', groups', small or medium-sized oil companies' drilling, production and operating problems in Central and Western Texas and New Mexico. Personal interview by appointment is desired. Makin Drilling Company, Box No. 1628. Ph. No. 3-3141, Hobbs, New Mexico.

WYOMING OIL GEOLOGIST, 14 years' comprehensive exploratory background, 9 years in Rockies, wants full or part time position in Casper. Box H-199, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED PRODUCTION AND DRILLING MANAGER

Presently employed by major oil company. Wishes to work for independent operator for reasonable salary and carried interest. Graduate Petroleum Engineer. 10 years management and field experience in drilling, production, and secondary recovery in Texas, New Mexico, Oklahoma, Louisiana, and Mississippi. Proration work all states. Married. Excellent recommendations, age 35. Salary less important than opportunity offered. Write Petroleum Engineer, P.O. Box 2035, Dallas, Texas.

ROYALTIES

JACK EAGLE, Oil Properties, 706 City Nat'l Bldg., Oklahoma City, Oklahoma. Telephone REgent 6-7027.

ONE-HALF undivided Fee Royalty in 309 acres under lease. Rig on location and will be drilling soon. Approximately 12 month pay-out. $30.00 per acre. Described in our Drilling Block advertisement herein. Petroleum Service Company, P.O. Box 1493, Fort Worth, Texas.

LEASE AND DRILLING BLOCKS

CHEAP Venture Fracture Possibilities: 160 acres, drilling well, between 4 new wells. On semi-proven structure. 1/32—$150; 1/16—$275; ⅛—$500. Laurence Price, Coweta, Okla.

SALE OR FARMOUT—All or part 18,000 acres Fremont Co., Wyo. Production three sides. 1068 acres Weston Co., Wyo. Close to production. L. K. Strauss, Temple, R. D. 1, Pa. Phone Reading 9-4673.

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Bought—Sold—Financed—Developed

Inquiries Invited

AMERICAN OIL SCOUTS

Dept. OJ, 7321 Beverly Blvd., Los Angeles 36, Calif.

OIL MEN — INVESTORS
SOUTHWEST WYOMING

MAJOR STRUCTURE—parallel to important producing oil fields, to drill. Recommend leases or royalty on structure this important area. Complete technical data on request.

W. J. PETERMAN, Geologist
1918-1954

Portales **New Mexico**

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Close in Leases

4000 ft. Arbuckle test. Salinas Basin. Structural condition indicates well location is well selected.

IVAN H. MOORE
Coffeyville, Kansas

UNUSUAL OIL AND GAS LEASE OFFERED FOR IMMEDIATE SALE

Located in the Cunningham Pool, Pratt County, Kansas. Section 11, Twp. 28 North, Range 11 East. 640 acres. Three producing wells were drilled on this lease in 1941. ONE GAS WELL—5,900,000 cu. ft. daily. One oil well—1,609 barrels daily. One oil well—514 barrels daily. THERE ARE FOUR EAST OFFSET WELLS JOINING THIS LEASE. One direct east offset, 3000 barrels daily. One direct east offset 165 barrels daily. One double east offset 11,000 barrels daily. One double east offset 27,500 barrels daily. Producing horizons—Topeka Lime, 2900. Lansing, 3537—Mississippi, 3990 — Kenderhook, 4005 — Viola, 4177—Simpson, 4272—Wilcox, 4282. Three year straight commercial lease. Call or write the office of **James P. Devine, Attorney, Ritz Building, Tulsa, Oklahoma. Phone 3-0858.**

LEASE AND DRILLING BLOCKS

80,000 ACRES: Mineral timber land, Tennessee—$3.50 per acre, all mineral rights. Details—E. Jester, 12744 Vanowen, North Hollywood, California.

FOR SALE: Colorado lease and mineral rights. Small or large acreage. See or write E. H. Grantham, Ordway, Colo. Phone 9921 or 2327.

WILL pay cash instantly for lease (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

SEE A. L. BOWLES, Box 947, Ada, Okla., for attractive drilling deals and producing royalties.

PRODUCERS to drill second offset well on Brown-Coleman County line, Texas, in near future. 3 possible pays. Nearby sandstone outcrop samples show hydrocarbon fluorescence. Geology and Geophysics same as surrounding 7 prolific Fields. Possible new Field. 1/16 Working Interest in well and 100 Acre drilling block for $640.00. Petroleum Service Company, P.O. Box 1493, Fort Worth, Texas.

FOR SALE: 320 acres plus ⅛ mineral. 8 miles south of Elk City. Box 7561, Lakeside Station, Oklahoma City 16, Okla.

160-ACRE lease Stephens County, Okla. for sale or development. 2 flowing wells high production on adjoining land. Address Box 572, Chickasha, Okla.

2100 ACRES, 4 miles South East Forest discovery in 7 S. R. 31 E. Chavez County, New Mexico. Drilling proposition wanted. Box 785, Station H, Los Angeles, California.

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Producing and Nonproducing
Bought and Sold—Any Area
Inquiries Invited

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6635 Delmar Ave., St. Louis 5, Mo.

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A method that locates the oil body whether in a stratigraphic deposit or in a structural deposit.

Has been developed and proven during 49 YEARS of practical field research and operations.

NOT an experiment nor a theory.

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OPPORTUNITY FOR CAPITAL

Reliable firm of Registered Professional Petroleum Engineers, with long and varied technical and practical experience in drilling, oil and gas property management and development, and secondary recovery operations, desires contact with substantial sources of capital interested in oil and gas prospects and properties.

Not interested in promotional ventures, but willing to exchange references and discuss terms with desirable and suitable clients.

Box H-187, The Oil and Gas Journal, Tulsa, Oklahoma

BUSINESS OPPORTUNITIES

PARTNER WANTED: I wish to form an association with some reliable individual Oil Drilling Contractor, Operator, Geologist or Petroleum Engineer, who already has or can get good drilling deals. At this time I am in position to raise Capital for drilling several wells. Exchange of references essential. Box H-166, The Oil and Gas Journal, Tulsa, Oklahoma.

CAPITAL WANTED

NEED CAPITAL for developing Oklahoma leases. Major company will provide detailed geophysical data on areas involved. Reply Box H-177, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE—MAPS

NEW WILLISTON BASIN MAP CONTOURED

DATUM — MISSION CANYON — Along eastern side of basin, contured on LODGEPOLE where Mission Canyon is not present.
This map has been accurately drawn to scale. Tops have been checked on all wells.
Work compiled by Independent Geologist, John H. Lapp.
Basin Area Coverage: North Dakota, South Dakota, Eastern Montana, North East Wyoming; South Eastern Saskatchewan and South Western Manitoba.
Scale 1" — 12 Miles. Size 59"—60"
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Box 1234, Bismarck, North Dakota

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Factors making for Pleasant Living:
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LEGAL

Sealed bids for Oil and Gas Mining Leases on restricted Tribal and Allotted lands of the Fort Berthold Indian Reservation, North Dakota, will be received at the Office of the Superintendent of the said reservation, New Town, North Dakota, until 2:00 P.M., Central Standard Time on June 1, 1954, and will be opened immediately thereafter in the presence of such bidders as may attend. There are 1,028.23 acres of Tribal lands and 24,423.40 acres of allotted lands for a grand total of 25,451.63 acres. All of this land is located in the counties of Mountrail, McLean, and Dunn, State of North Dakota. For additional information write the Superintendent of the Fort Berthold Agency, New Town, North Dakota, or call the Agency Land Office, phone 684, New Town. Ralph M. Shane, Superintendent.

WILDCAT COMPLETIONS

(Continued from page 188)

Niobrara County: Brazell & Wrather 1 Gaskill, C SW NW 9-40n-65w. Dry. TD 7,610 ft.

Washakie County: Mountain States Drilling Co. 1 Government-Phillips, NE SW SW 4-46n-90w. Dry. TD 9,337 ft. in Tensleep.

Shannon Oil Co. 1 Government-Gardner, SW SW SW 31-44n-91w. Dry. TD 4,976 ft. in Tensleep.

Weston County: T. W. Eggleston 1 Pollat, NE SE NE 34-44n-65w. IPP 30 BOPD, Newcastle sand. TD 5,935 ft.

COLORADO

Baca County: Amerada Petroleum Corp. 1 Robbins, NW NW SE 3-32s-42w. Dry. TD 3,460 ft. in Lansing-Kansas City.

El Paso County: K. D. Owen 1 State "B," SE SE NW 21-15s-62w. Dry. TD 5,978 ft. in Morrison.

Logan County: Balderson Denver Drilling Co. 1 Hosford-Daniels, SE SW SE 32-8n-55w. Dry. TD 5,643 ft.

Claycomb, Guida & New Drilling Co. 1 UPRR, NE NE NE 3-11n-53w. Dry. TD 5,483 ft.

Ryan Oil Co. 1 Writebol, C NW NE 31-8n-53w. Dry. TD 5,200 ft.

E. H. Stone and New World Oil Co. et al 1 McLane, NW SW NE 34-7n-54w. Dry. TD 5,105 ft.

Morgan County: Howard Chamlee, Buck Wilson and Dee Miller 1 Dilley, NW NW NW 13-6n-55w. Dry. TD 5,315 ft.

Harper-Turner and Dunn & Boreing 1 State, C SE NW 23-2n-57w. Dry. TD 5,601 ft.

S. D. Johnson 1 Bollinger, NE NW SE 27-4n-55w. Dry. TD 5,181 ft.

McMahon and Bollington 1 State, SE SE NE 27-3n-58w. Dry. TD 5,880 ft.

J. A. McRae 1 Peterson, SW SW NW 16-1n-55w. Dry. TD 5,180 ft.

Rocky Mountain Oil Field Contractors 1 Stumpf, NW NW NE 11-3n-57w. Dry. TD 5,486 ft.

Rocky Mountain Standard and O'Donnell and Edmondson 1 Bollinger estate, SW SW SW 23-2n-55w. Dry. TD 5,350 ft.

Ryan and S. D. Johnson 1 Cochran, SE SE SE 3-1n-58w. Dry. TD 6,025 ft.

Washington County: S. D. Johnson 2 Bollinger, NE NE NW 30-4n-54w. Dry. TD 5,220 ft.

Plains Exploration Co. 1 Vondy, NE NE NE 13-2s-56w. Dry. TD 5,175 ft.

Twin T. Drilling and Producing Co. 1-19H Shug, NW NW SW 19-3s-56w. Dry. TD 5,360 ft.

Weld County: Barnes & Brown and S. D. Johnson 1 Werner-Peters, C NE NW 33-12n-61w. Dry. TD 7,756 ft.

Fallon Gas Co. 1 Old Coot, NW NW SW 1-4n-61w. Dry. TD 6,454 ft.

Gilliam Drilling Co. 1 Rodman et al, NW SW NW 10-8n-56w. Dry. TD 5,890 ft.

Shell Oil Co. 1 Vangraefschepe, C SE NW 28-7n-57w. Dry. TD 6,160 ft.

MANITOBA

Baysel 8-31 Roselea, LSD 8, 31-10-25w1. Dry. TD 1,839 ft.

Perry Fulk 1 Daisie Longman, LSD 16, 27-8-28w1. Mississippian oil well. TD 2,889 ft.

SASKATCHEWAN

Tide Water-Hudson's Bay 7 Chaplin Lake Crown, LSD 12, 35-19-7w3. Dry. TD 3,720 ft.

Tide Water 13-32 East Dollard Crown, LSD 13, 32-7-19w3. Dry. TD 4,696 ft.

ALBERTA

Fina Husky Triad 15-22 East Malmo, LSD 15, 12-44-22w4. Poplar oil well. TD 6,050 ft. PBTD 4,770 ft.

Stanolind-H.B. A-1 Pembina Crown, LSD 12, 13-48-9w5. Cardium oil well. TD 5,366 ft.

International

(Continued from page 93)

loading facilities will be constructed so small tanker barge cargoes may be loaded and shipped temporarily until submarine facilities can be completed.

This oil will be sold to the Egyptian Government refinery at Suez, according to Scott A. Murray, Mideast division manager for Southern California Petroleum Corp., which is in charge of the operations in Egypt under contract with International Egyptian.

The refinery, located about 100 miles north of the Feiran marine storage locations, needs about 10,000 bbl. of crude per day additional production in order to supply Egyptian domestic needs. The plant is now being modernized and enlarged.

Company plans called for six rigs to be in operation by the middle of May. This includes resumption of drilling on 1 Sidri which was halted at 5,190 ft. by a high head-water flow. *(The Oil and Gas Journal, March 29, 1954, page 78).*

Petrobras Has New Chief

Col. Juracy Magalhaes has taken over as president of the new Brazilian state oil enterprise, Petroleo Brasileiro, S. A., or Petrobras.

Colonel Magalhaes in a short talk at his induction outlined the tasks confronting the company and said that "instead of just talk, we are going to work hard." He said Petrobras will continue extensive exploration, seek to increase output of existing fields, promote efficiency at the state-owned refineries, and add to the national tanker fleet.

The new head of Petrobras is the former Brazilian military attache in the United States. The agency which he now directs was created by law last year *(The Oil and Gas Journal, November 9, page 79).* With financing from heavy taxes on motor vehicles, boats and aircraft, Petrobras is designed to provide maximum government exploitation of the republic's oil resources. Private companies are excluded.

Petrobras has an initial capital amounting to four billion cruzeiros, or about $82,000,000, in the form of fields, refineries, tankers, and equipment taken over from the old Conselho Nacional do Petroleo which becomes an advisory agency. From the taxes

provided in the law and earmarked for the oil undertaking, Petrobras hopes soon to increase its capital to ten billion cruzeiros, or about $205,000,000.

Iranian Deadlock

Both sides seeking control when industry reactivated

NEW YORK.—A deadlock has developed in the Iranian oil negotiations over who will control the management of the reactivated industry.

A delegation of some 22 members representing the newly formed, eight-company international oil consortium has been negotiating since mid-April with Iranian government officials in Teheran, and an early agreement to bring the Iranian oil properties back into operation had been predicted.

The three top consortium negotiators —Orville Harden, Standard Oil Co. (N.J.), H. E. Snow, Anglo-Iranian Oil Co., Ltd., and J. H. Loudon, Royal Dutch-Shell—were scheduled to fly to London this week for further discussions with other officials on the consortium companies.

In Teheran, it was reported that the three leading consortium negotiators hoped to be back in Teheran in about 2 weeks and it was presumed the negotiations will resume then.

Both the Iranian government and the consortium are insisting on having management control when production and refining are resumed in Iran.

International Briefs

The Mantova, Italy, refinery of Industrie Chimiche Italiane del Petrolio is expected to be placed in full operation in the next 2 or 3 months. The plant has a crude distillation capacity of 10,000 bbl. daily.

British Malayan Petroleum Co., Ltd., (Royal Dutch-Shell) has begun work on the construction of a 6-mile-long sea wall to protect its Seria field in Brunei from erosion from the South China Sea. The wall will take 18 months or more to build, and eventually will rise 5 ft. above the highest water mark ever recorded.

A small T.C.C. unit of about 3,200 bbl. daily capacity will be placed in operation in May by Ste. Cherifienne des Petroles at its refinery at Petitjean in French Morocco. The plant operates on indigenous Moroccan crude produced in the nearby fields of the French-owned company. The unit was designed and engineered by Hydrocarbon Research, Inc.

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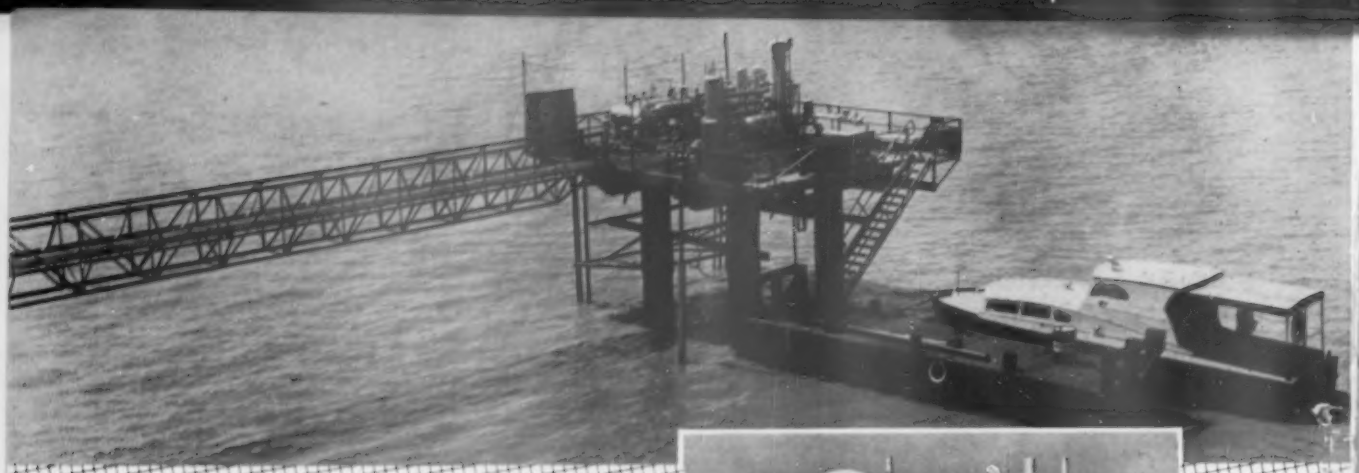

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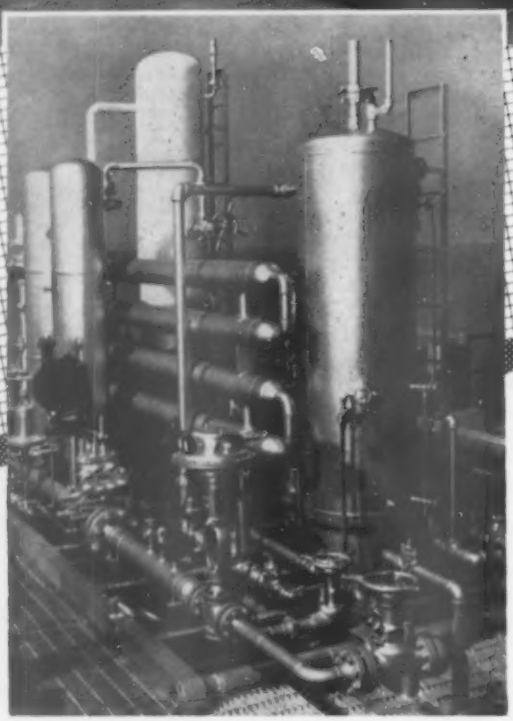

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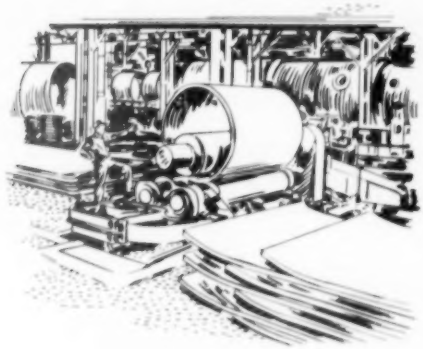

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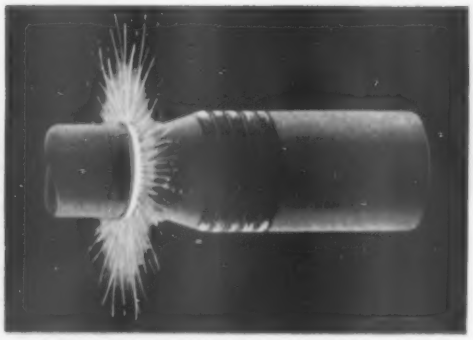

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TEXAS FIELDS AND GEOLOGICAL STRUCTURES

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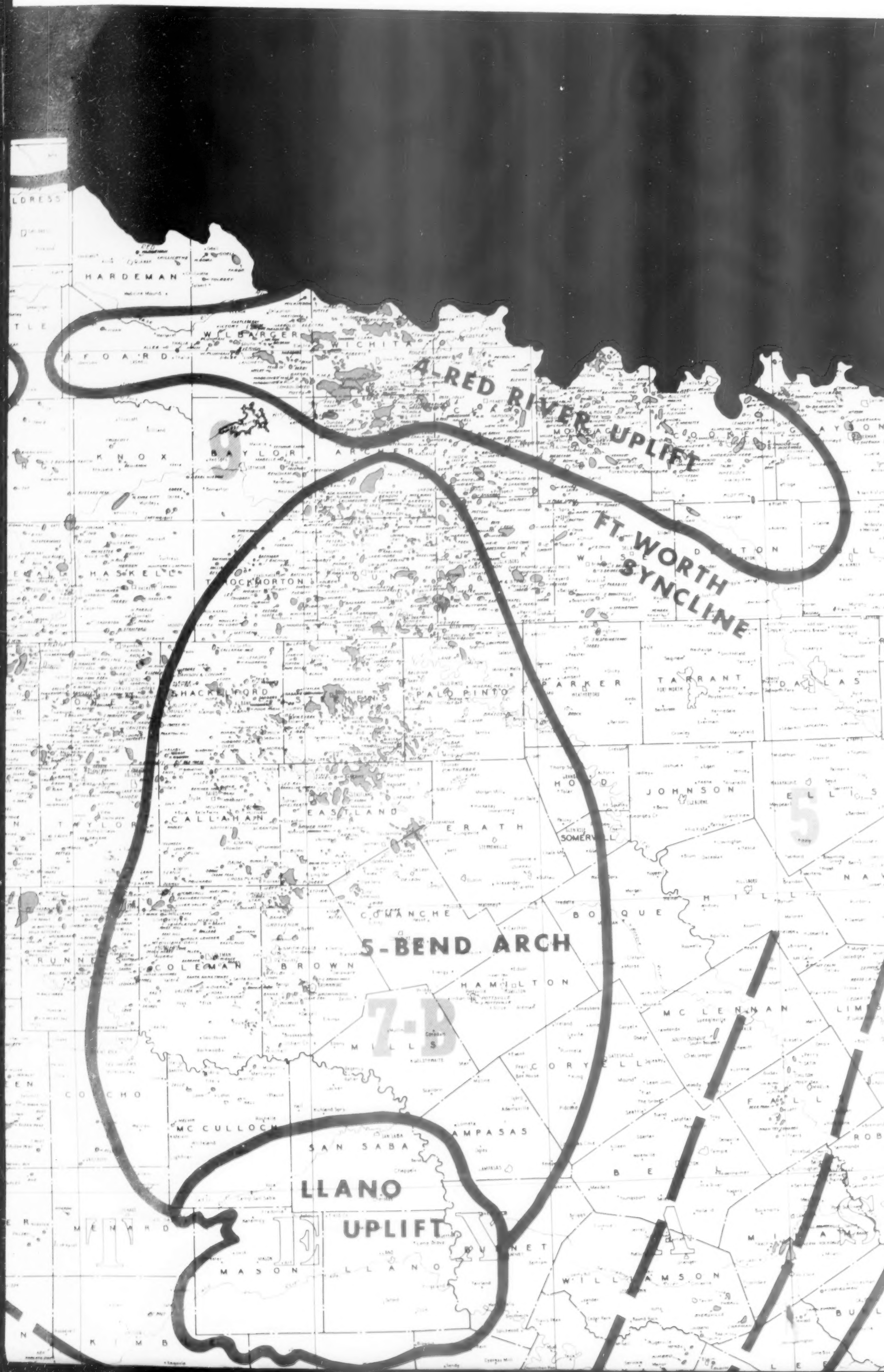
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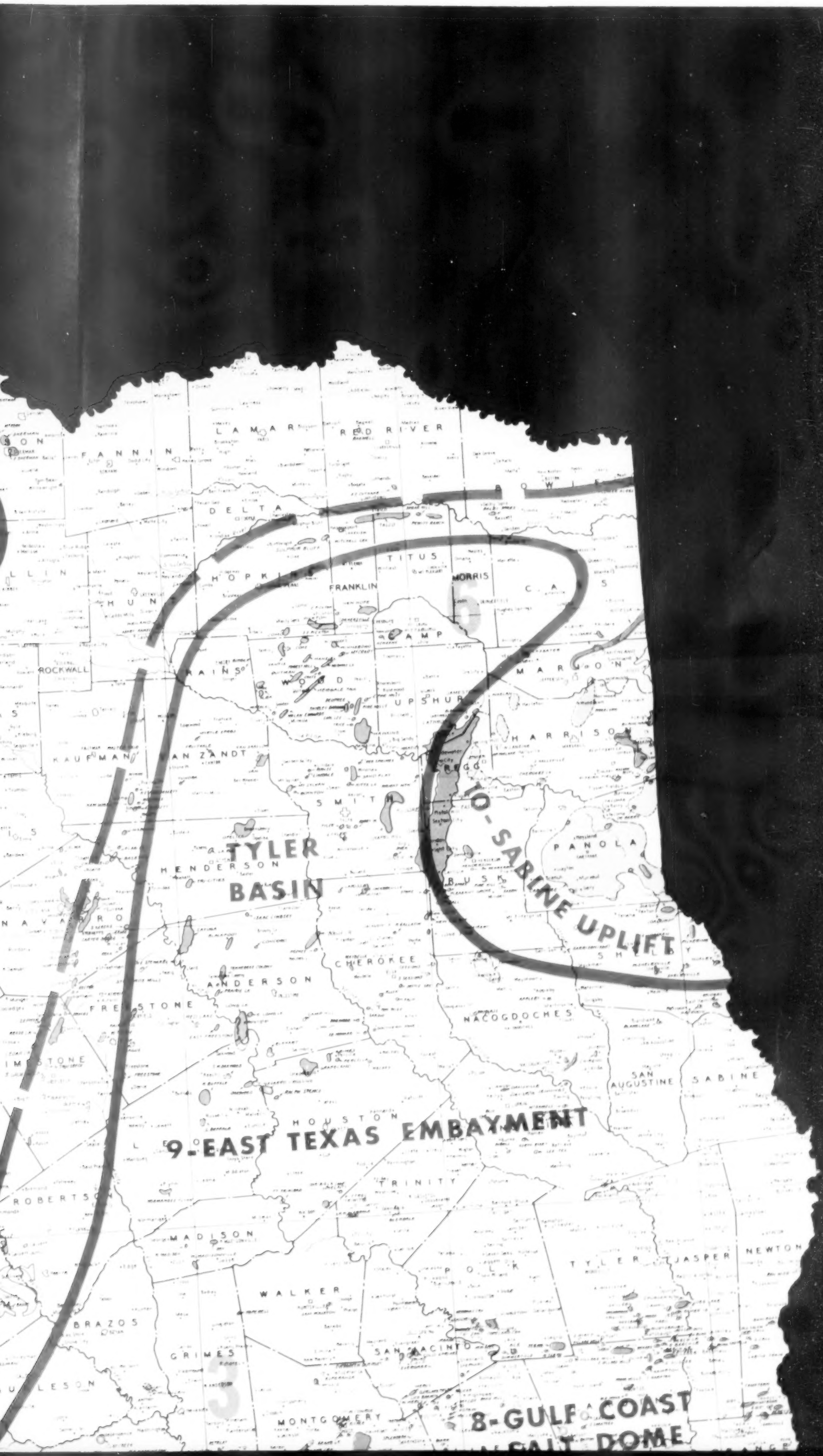
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INTRODUCTION

This map was prepared to provide an objective look at the effect of regional geology on oil and gas accumulation. By superimposing a surface oil field map upon a subsurface map showing the major structural features of Texas, a striking illustration of the relationship between structure and accumulation is achieved.

Those structural features that have had a direct effect in producing the environment necessary for the formation of oil pools ar described briefly below; major features that have had an indirect effect of possess geological interest only are outlined on the map without further description.

1 — TEXAS PANHANDLE

THE AMARILLO UPLIFT . . . The major structural feature of the Texas Panhandle, dividing it into two parts.

This buried granite ridge is a continuation of the Wichita Mountains of southwestern Oklahoma, entering Texas in Wheeler County and extending northwest for more than 100 miles to Moore County. The uplift is aysmmetrical, with a steep northern flank and a more gentle southern one. Several faults and minor structures are associated with the uplift. A fault zone with displacements of several thousand feet is believed to lie along the steep northern flank of the Amarillo uplift.

Extending south from the Oklahoma Panhandle lie the Keyes anticline and Stratford dome. These uplifts are not northern extensions of the Amarillo uplift, but separate features trending toward the ridge and meeting it in Moore County. They separate the Dalhart and Anadarko basins.

ANADARKO BASIN . . . The western end of the Anadarko basin lies just north of the Amarillo uplift. This basin is also asymmetrical with a steeply dipping south flank and a more gentle north one. The basin covers an area of about 35,000 square miles in western Oklahoma, the Texas Panhandle, and southwestern Kansas-southeastern Colorado. Sedimentary rocks in the basin are of Paleozoic age for the most part, ranging in age from Cambrian through Permian.

The basal limestones and dolomites of the Permian are the gas and oil-bearing beds of the Panhandle and Hugoton fields. Panhandle field is a structural trap, producing from dolomites and granite wash, while Hugoton field is a stratigraphic trap, also producing from dolomites.

Lips field is the only large producing area lying out in the Anadarko basin area of the Texas Panhandle. Several small fields have been established along the flanks of the Amarillo mountains' north side. Two new Pennsylvanian producing areas have been opened in Hansford County off the flank of Hugoton field. Production is from the Douglas sand of lower Missouri age, a new pay for the Panhandle.

Extensions to Panhandle and Hugoton fields in either subsidiary structures or extensions of the type and area of reservoir rocks can be expected.

2 — DELAWARE BASIN

The Delaware basin lies in the western parts of Pecos, Ward and Winkler counties, and in Culberson, Reeves, and Loving counties; it extends into eastern Eddy and western Lea counties, New Mexico. It is looked upon as the last true exploration frontier in Texas.

The basin is an elliptical, northerly trending feature that parallels the Central Basin Platform. In Texas it is about 90 miles long and 45 miles wide. The western flank of the basin is gently dipping; the eastern flank, however, rises abruptly against the Central Basin Platform.

Gentle regional subsidence occurred during early Pennsylvanian time accompanied by broad uplifts, arching, folding, and faulting. These movements continued upward into lower Permian time and may account for the folding and faulting found in the Wolfcamp and Leonard sections. During Tertiary time, the western part of the basin was uplifter and blockfaulted. This orogeny apparently rejuvenated the earlier Pennsylvanian tectonic pattern. Wolfcamp sediments rest with angular unconformity upon folded and faulted Pennsylvanian beds.

Production to date has, for the most part, been from sands of the Bell Canyon formation (Guadalupean), usually called the Delaware sand.

The Delaware basin has 25 oil and two gas fields with about 400 producing wells. Among the more important are Wheat, Mason, Tunstill, Scott, and Red Bluff.

This basin has over 10,000 square miles of area with only 100 square miles of proven production. The sedimentary section is at least 13,000 ft. thick. Numerous oil shows have been reported in all parts of the section and the potential reservoirs are widespread.

The Delaware basin should be the next major producing area of Texas.

3 — PERMIAN BASIN

The Permian basin is a vast structural feature which, with interruptions of less extensive structures, extends from the Pecos valley of Texas north-northeastward through Texas and adjoining parts of eastern New Mexico, through western Oklahoma, central Kansas, and into Nebraska. It is believed to have originated in early Paleozoic time. It is a great regional subsurface depression, but is by on means a simple "basin," for pronounced uplifts and subsidiary basins occur within its limits a structural interruptions to the continuity of the regional feature.

Five structural constituents of the southern part of the basin are vital elements in the consideration of oil occurrence in West Texas and New Mexico; these are the Delaware basin (discussed elsewhere on the map), the Midland basin, the Central basin Platform (separating the Delaware and Midland basins), the "Northwestern Shelf," and the "Eastern Platform" (both still undefined). The "South Permian basin" includes an area south of the Matador arch some 250 miles wide and 300 miles long.

NORTHWESTERN SHELF . . . Actually a shallow-water phase of the Midland basin, the Northwestern Shelf has accounted for some large oil accumulations, including the Slaughter-Levelland, Prentice, and Wasson fields in Texas, and the Artesia-Vacuum trend in New Mexico. Production is from San Andres and Clear Fork formations of the Permian, and in recent years, from the Pennsylvanian, Devonian, and Mississippian.

Little is yet known of the areal extent of the Northwestern Shelf, but to the north, it gives way to the Matador Arch, a great east-west uplift between the Midland basin and the Plainview basin. Geological definition will come with additional drilling and the promise of new fields on the shelf is great.

EASTERN PLATFORM . . . The eastern margin of the Midland basin presents structural problems of a different nature from those of other West Texas areas. The Permian section here is of the carbonate or platform type. Reef growths in Permian and Pennsylvanian time provide prolific oil reservoirs, and their detection is difficult.

As a rule, post-Mississippian erosion and uplift have resulted in deposition of the Pennsylvanian directly upon beds of Mississippian and Ordovician age; it is believed these conditions are responsible for the growth of the barrier reefs.

Principal fields on this platform are the Scurry County reef fields (Diamond M and Kelley-Snyder), Cogdell, Salt Creek — all Pennsylvanian producers; and Garza, Iatan, Howard-Glasscock, all Permian fields. Other fields on the platform produce from the Mississippian.

Most recent development on the eastern edge of the Eastern Platform is the discovery of prolific production from the Cambrian sands and limes in Nolan, Coke, and Fisher counties.

MIDLAND BASIN . . . This, the larger of the two subsidiary depressions of the Permian basin, is shallower than the Delaware basin, but much greater in areal extent. Its northern limit lies in southern Hockley County, and the southern limit in northern Crockett County, lending a northwest-southeast trend to the basin axis. It is terminated abruptly on the southwest by the Central Basin Platform, and less suddenly on the east as the formations rise up to the Eastern Platform in the vicinity of a line from Garza to Schleicher counties. It therefore is more of a trough than a basin.

Production in the Midland basin has been established from Ordovician, Silurian, Devonian, Pennsylvanian, and Permian formations. Principal individual formations in the producing column are the Ellenburger, Strawn, Canyon, Wolfcamp, Spraberry, Clear Fork, and San Andres. Producing depths vary from 2,000 to 12,000 feet.

Some of the larger fields within the Midland basin are the great Spraberry Trend Area, Benedum, Pegasus, Big Lake, Midland Farms, Mabee, Welch, Adair, and Cedar Lake.

CENTRAL BASIN PLATFORM . . . A buried "mountain" platform separates the Midland and Delaware basins, and has been the scene of intensive oil development unequalled anywhere else in Texas. Relatively shallow producing depths resulted in rapid drilling of the known prospects, and even today, the platform is an active region.

The Central Basin Platform is a thumblike projection extending out into the old Permian sea from southeastern New Mexico. It was formed in early Pennsylvanian time as a series of en echelon mountain uplifts, and thick Permian deposits were laid down atop the old eroded surface. Varied reef and lagoonal deposits lend credence to this epositional history. The reef rocks are very thick dolomitic limestones of Permian age, and on the margins of the platform, elongated sand bodies constitute lagoonal sand phases, also of later Permian age.

Principal producing formations on the platform are the Yates and Queen sands, Grayburg and San Andres limestones, Clear Fork and Glorieta sands and limes, and in recent years, flush production has come from Ordovician limestones. Some production comes from rocks of every period of the Paleozoic era.

History-making fields have been discovered on the Central Basin Platform; these include McCamey, Hendrick, South Ward, North Ward, Goldsmith, Cowden, McElroy, and the fabulous Yates pool, scene of the only well ever recorded in the United States with a flow of 8,000 bbl. of oil in a half-hour.

Fields continue to be discovered on and near the flanks of the platform, and as stratigraphic study continues to shed light on subsurface conditions, more oil will doubtless be found in future years.

4 — RED RIVER UPLIFT

A buried structural feature extending along Red River from Denton County to Cottle County or beyond. The uplift is not a continuous ridge, but a series of scattered granite peaks along a fairly continuous upland, and it is blanketed by overlying Cretaceous and Paleozoic sediments. While the buried ranks has an east-west length of about 200 miles, its width is slight. There are isolated peaks, but for the most part, they occur in semi-ranges, separated by saddles; and spurlike ridges are known to cross Red River toward the Wichita Mountains of Oklahoma.

Two principal structural divisions of the uplift have been described: the Electra arch makes up the western part, lying in Clay, Wichita, Wilbarger, Foard, and Cottle counties; the eastern end, plunging southeastward through Denton, Cooke, and Montague counties, is known as the Muenster arch.

Here are some of the oldest fields in Texas; commercial activity began in 1904 with the discovery of Petrolia (Henrietta) field in northern Clay County. Hundreds of individual pools have been developed, and even today, it is one of the most active development areas in the state. Continual discovery of new pays has kept the region in the light. Some of the larger fields in Hull-Silk-Sikes, KMA, and the fam burnett fields.

Principal producing sands in Pennsylvanian, Mississippian, an sands and limestones. In the olde lific production came from sands yon, Strawn, and Bend age; rece seen major development in pays of pian and Ordovician.

Future development prospects a lent in the Red River area; as mo is gained of sursurface structural pecially in the early Paleozoics, ne will continue to be discovered.

5 — BEND ARCH

The Bend Arch is a northward gional nose, and the most pronounc nating from the Llano uplift. It ward from this uplift through N Texas to central Archer County, 160 miles; its average width is ab It dips northward at 35 ft. per m

The arch is asymmetrical with steep east flank.

In the early Pennsylvanian fo Bend Group is separated from the vanian beds by an unconformity. F structural conditions in the Bend more complicated than in the ov and the structures become more this unconformity.

The Bend Arch underlies an exte lific oil and gas producing region. production is associated with lo features on this arch. Typical field Breckenridge, and Cisco.

Principal producing zones are in age (Cisco, Canyon, Strawn, Be ranging from a few hundred feet t ft. Strawn production was first the arch around 1870 by accident; mercial wells were drilled as early area has been actively explored fo since 1890.

The Bend Arch is continuously interest because of its shallow dep fields. The Cambrian formations pay horizons that could put additi into this part of Texas.

6 — CENTRAL TEXAS FAU

BALCONES . . . The Balcon extends from Uvalde County to n in McLennan County as a narrow or gravity faults. The faulting is able in Uvalde and Travis count trend curves around the Llano upl cones escarpment is a prominent feature that was recognized as ea

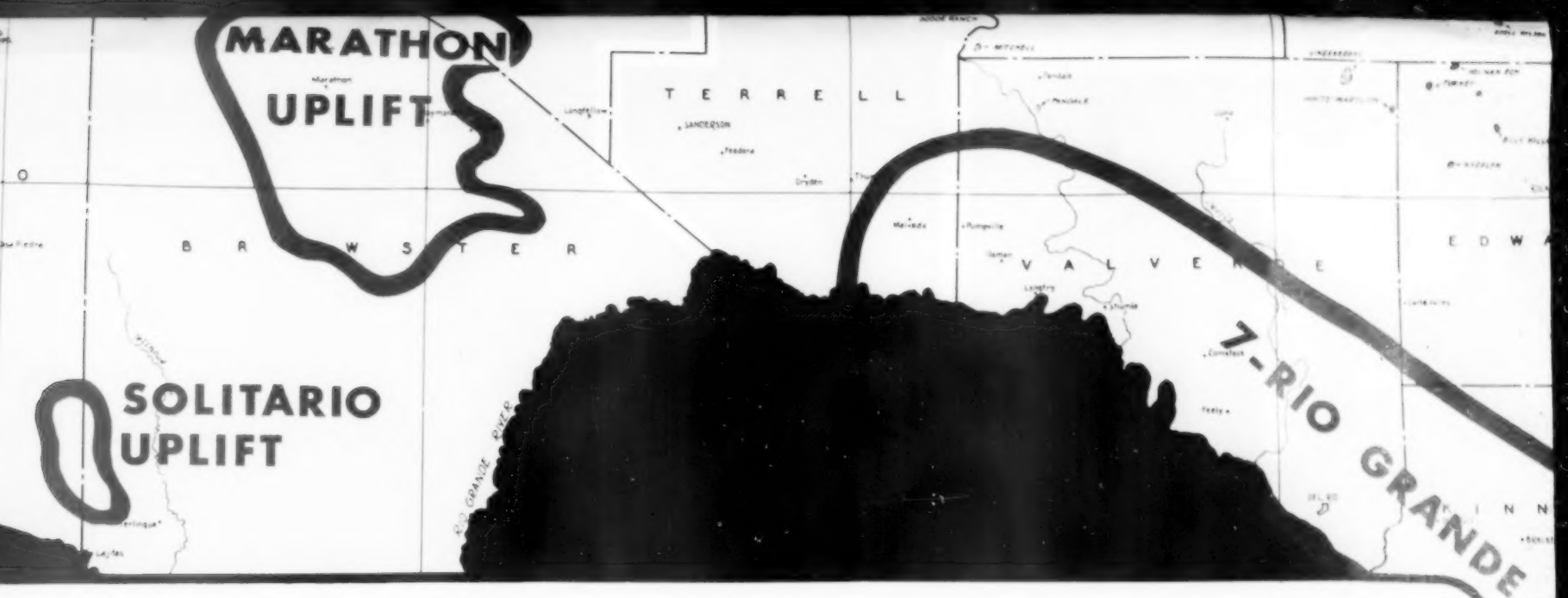
The individual faults are en ec not exactly parallel the trend; di these faults varies from a few feet ft. The faults are usually downth east. Movement along the trend curred over a relatively long perio time; recent minor earthquakes ported along the zone.

LULING-MEXIA-TALCO . . . Mexia-Talco fault zone parallels and extends from the Louisiana and Titus counties south and west County. It probably continues Arkansas. Most of the faults on downthrown to the west.

The Balcones and the Luling-Mex zones form the boundaries of a n 30-50 miles wide that skirts the L

The faulting and folding along are responsible for many of the oi area such as Talco, Mexia, Powell Darst Creek. Each of these field produce over 100 million barrels

Principal producing zones are Lower Cretaceous sands and lim



STRUCTURES IN TEXAS

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the Woodbine sand and Edwards lime being major producing zones.

Production in the graben at Hilbig, Manda, Thrall, Kimbro and Lytton Springs is from serpentine plugs of Taylor-Austin age.

These trends are a popular exploration area, especially for the independent, because of the multiple shallow pay zones, low cost of drilling, and the acreage situation.

7 — RIO GRANDE EMBAYMENT

The oil province commonly known as "South Texas" covers Railroad Commission districts 1, 2, and 4 as shown on the map. It lies within the Rio Grande embayment, a huge transverse syncline lying partly in Texas and partly in Mexico, and dating from at least Jurassic time. It is separated from the deeper Gulf Coast salt embayment by a poorly defined, broad subsurface arching known as the San Marcos arch (on a line between the Llano Uplift and Lavaca Bay).

The embayment persisted throughout Cenozoic time as the Coastal Plain emerged from the sea and the present-day coast indentation in the vicinity of Nueces, Kleberg, and Kenedy counties is a reflection of its presence today.

Hundreds of oil and gas fields, large and small, have been discovered in the Rio Grande embayment. Two principal geologic features are the contributing cause of most of the accumulations; these are the Mirando shoreline and the Vicksburg flexure (or "Sam Fordyce-Vanderbilt fault zone").

MIRANDO SHORELINE . . . An accurate trend of stratigraphic trap-type oil fields from Zapata County northeast to DeWitt County is known as the Mirando shoreline trend. Most of these pools are attributable to updip sand pinchout, monoclinal sand lenses, offshore bars, or "shoestring" sands. These traps resulted from alternation of regressive and transgressive seas during the gradual emergence of the area in faulting are associated with the lensing.

Principal producing sands in the shoreline trend are of Jackson and Claiborne (Upper Eocene) age, with recent discoveries in sands of Wilcox age assuming ever greater importance. Some of the principal fields are Government Wells, Seven Sisters, Bruni, Escobas, Mirando Valley, Lopez, Hoffman, and Pettus.

VICKSBURG FLEXURE . . . Coastward from the Mirando trend about 40 miles, a second trend of deeper-buried oil pools occurs along a series of normal faults known as the "Sam Fordyce-Vanderbilt fault zone." These extend from eastern Starr County on a northeast line to Jackson County.

The Cenozoic formations thicken appreciably as they dip toward the Gulf of Mexico, and the seaward dips steepen considerably, forming a "flexure" or "hinge line" along the point of greatest change in dip and thickness. Thus, the combination of thick formations, accentuated dip, and normal break in slope at the buried margin of the ancient continental shelf has produced a zone of weakness. Along this trend, faults have occurred and innumerable oil traps, large and small, have developed.

In these fields, the Oligocene, Frio and Vicksburg sands are the major reservoir bodies. Great pay thickness, and multiple pays (sometimes 20 or 30 per field) are the order of the day. These factors, combined with the occurrence of other unrelated domes, anticlines, and strat traps, have resulted in some unusually prolific fields. Chief among these are Seeligson, Sun, Rincon, La Gloria, Agua Dulce, Greta, West Ranch, Tom O'Connor, Refugio, and others.

Discoveries of new structures and ever deeper pays in both the Mirando and Vicksburg trends promise many years of active exploration and development for the future of the South Texas area.

8 — GULF COAST SALT DOME EMBAYMENT

While not truly a separate embayment, this area displays evidence of some of the greatest subsidence in the coastal province extending from Mississippi to Rio Grande River. Its principal and most famous characteristic is the presence of 52 proven piercement and non-piercement salt domes, nearly all productive of oil or gas.

Origin of the salt is still a moot question, but most sources now ascribe it to the upward flow from a mother salt bed of probable Jurassic age. As the upthrusting took place, intervening layers of sediments were pierced and thrust aside. Some known salt domes have not pierced the overlying strata, but have arched them into large anticlinal structures. Many similar anticlinal anomalies on which salt has not been penetrated are believed to result from still deeper salt intrusion-arching.

On the map, these salt domes are shown as circles; they occur between Jackson County on the southwest, Tyler County on the northeast, Burleson County on the northwest, and are believed to occur far out into the Gulf of Mexico.

Principal producing horizons on these Gulf Coast domes are the beds of Tertiary and Quaternary age, with approximately 50% coming from Oligocene sands (principally the Anahuac and Frio-Vicksburg) and 50% from Eocene (Yegua-Cockfield and Wilcox).

Oil pools occur in sands arched over the caprock ("super-caprock"), within the caprock, or in sands flanking the salt core.

Many large oil fields occur in other types of structures in the embayment, such as large anticlines, often lying on the downthrown (coastward) side of normal faults possessing a general southwest-northwest trend. Stratigraphic traps are also common.

Some of the most famous fields in the world lie within this area: Spindletop, Old Ocean, Tomball, Conroe, Hastings, and Friendswood, Sugarland, Markham, and Liberty.

After 53 years, this Gulf Coast embayment area continues to be one of the most active exploration sites in the United States. Current activities center around the search for new traps, both structural and stratigraphic, on the outer flanks of the domes, and in the search for new and deeper pays. Other intensive drilling programs are in the offing to explore the offshore possibilities on the continental shelf.

9 — EAST TEXAS EMBAYMENT . . TYLER BASIN

The East Texas embayment includes a large part of the Northeast Texas coastal plain. It is believed to have originated in late Jurassic and early Cretaceous time. The embayment is limited on the west by the Luling-Mexia-Talco fault system and on the east by the Sabine Uplift. Its structural pattern is affected by the Sabine uplift.

Underlying much of the basin are salt deposits from which numerous salt domes have been formed constituting the inner salt dome province of the Texas Coastal plain. Sixteen shallow, piercement-type salt domes are known in the area.

In its earliest expression, the axis of the geosynclinal downwarping was southwest-northeast, but after Upper Cretaceous time, the structure assumed a north-south alignment in its southern half and swung around the Sabine uplift to the northeast, connecting with a similar basin in southwestern Arkansas.

The deepest part of the basin lies east of Athens (Henderson County) Texas. The axis of the basin pitches southward toward the Gulf of Mexico. From the east the strata dip into the basin from the crest of the Sabine uplift as much as 6,000 ft. From the north the dip amounts to 8,000 ft. in the distance from Red River to Tyler, while from the west the dip is about 7,500 ft. between Dallas and Tyler. On the south side the regional dip is about at the same rate toward the Gulf.

The important pay zone in the Northeast Texas embayment is the Woodbine at the base of the Upper Cretaceous and the Rodessa zones which lie in the middle of the Trinity group of the Lower Cretaceous. The highest producing zone is the Nacatoch sand which produces gas at Panola and some oil at Van and Corsicana. The Woodbine up to date has accounted for the bulk of the oil production in the embayment.

Principal fields in the basin are East Texas, Hawkins, Van, Long Lake, and Chapel Hill, producing from the Woodbine sand and from Trinity horizons (Glen Rose, Paluxy, and Travis Peak).

Big East Texas oil field, near the east margin of the embayment, is the result of a favorable combination of structural and stratigrahic conditions. Favorable stratigraphic conditions caused by Woodbine sands pinching out between relatively impervious strata form the trap.

The main producing zone in each of the fault trap pools along the Mexia fault zone is the Woodbine sand. Many of the pools in the area are on small domes. Only 10 per cent of the pools in the basin are monoclinal-lens pools. Fifty per cent are either faulted anticlines or lie along faults. The rest are on domes or on anticlines.

The area of the embayment is one of tremendous potentialities for oil production. The salt domes in the area hold exploratory interest. The Jurassic-Smackover, a big producer in Louisiana and Arkansas, is believed to cross the East Texas embayment. A recent discovery in Franklin County added promise to exploration to the Smackover.

10 — SABINE UPLIFT

The Sabine Uplift is one of the major structural features of the Gulf Coastal Plain. It is a large, flat-topped structure, nearly square in shape, and is part of a larger platform feature which dominates northern Louisiana and extreme northeastern Texas, where its western slope forms the eastern limit of the East Texas embayment. It is reflected on the surface by a large inlier of Midway, Wilcox, and lower Claiborne outcrops.

The uplift has a distinct northwest-southeast trend; the present course of Red River through northwestern Louisiana traverses its long axis.

Local structural features superimposed on the regional uplift account for the presence of many oil fields and large gas fields.

A southwestward-plunging broad syncline heads up dip in the center of the uplift about halfway between Shreveport and Mansfield, La. This is flanked to the northwest by a southwestward-plunging anticline running from the Bethany-Waskom gas field southwestward across Panola County, Texas. The oil fields on the higher part of the uplift have been localized at junctions of two tectonic strikes. The result of these two strikes is a westward-plunging hemianticline producing the westernmost projection of the uplift in northeastern Texas.

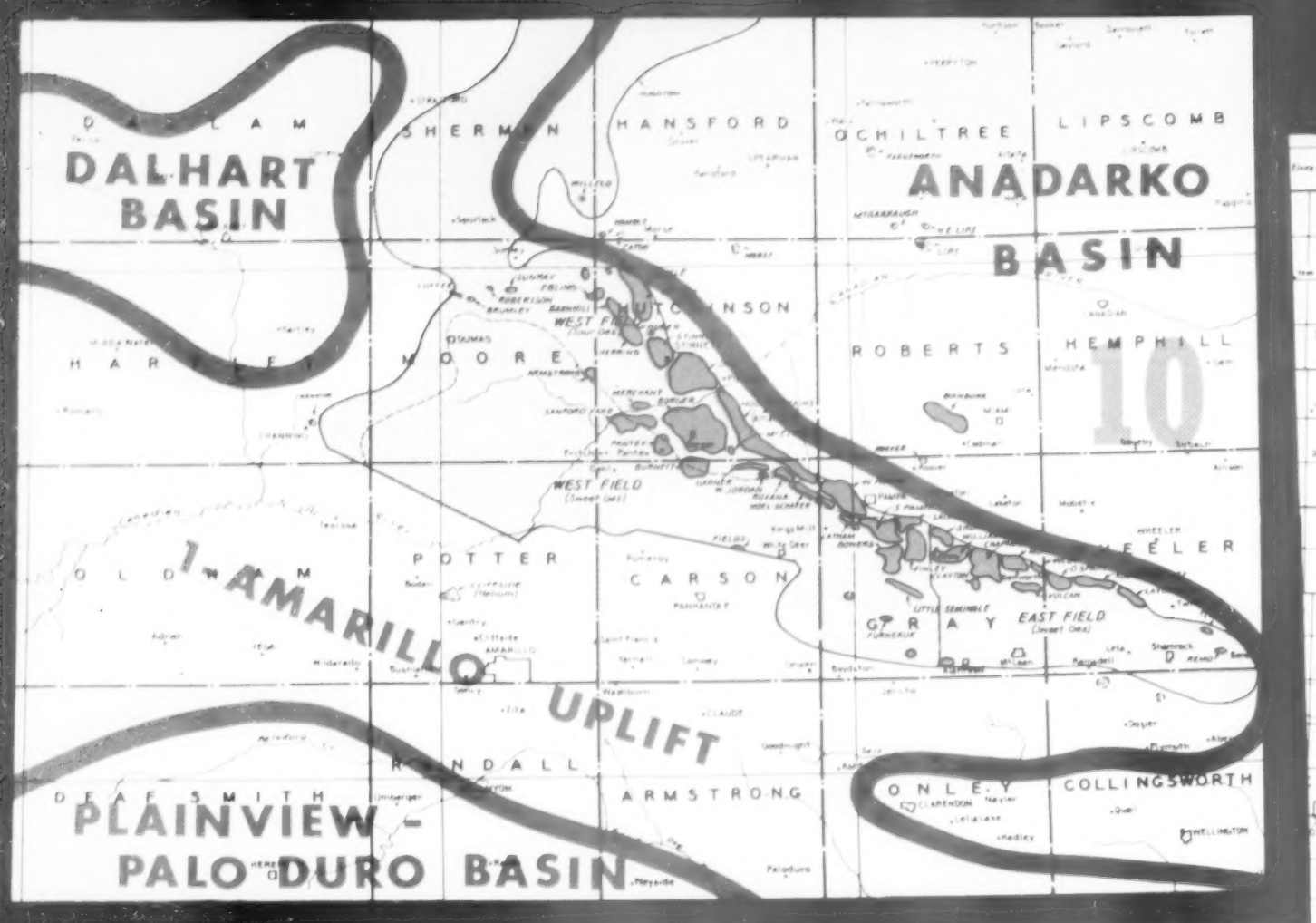
The most prolific Texas pools on the crest of the uplift are: Logansport, Bethany, and Waskom. East Texas field is the biggest producing area in the uplift area. This big field lies on the western flanks of the feature. Other major fields in Texas are Rodessa oil field and Carthage gas field.

The Upper Cretaceous of the Gulf series early came into prominence because of the large accumulations of oil found in the pools on the uplift. The lower portion of the Gulf series (especially the Woodbine) was for many years the principal source of oil on the Sabine uplift pools.

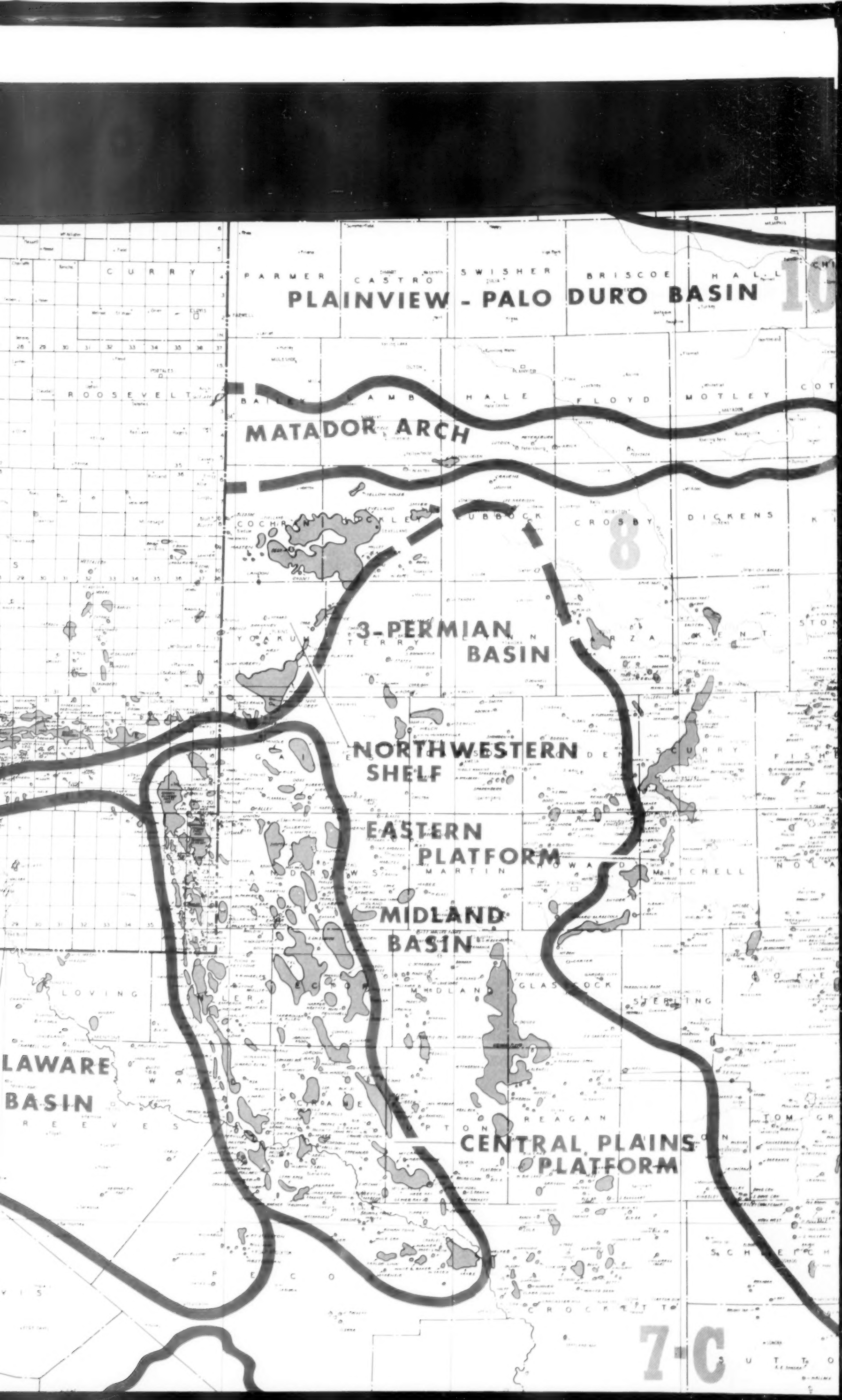
First deep production on the uplift was established in 1927 at Pine Island field, Louisiana, in the Trinity Group.

Intensive Cotton Valley exploration has been evident in recent years in several areas on the uplift. The largest accumulations of oil are found in the various sands and limestones of the Rodessa formation. Oil, gas, and distillate have been found in some of the porous zones of the Jurassic rocks.

A Smackover pool was opened recently in East Texas' Franklin County. Smackover exploration in and around the uplift in the future holds great promise, despite its great depth.



OFFICIAL NOMENCLATURE MAPS BY E.C. JACOBSON


PLAINVIEW - PALO DURO BASIN
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3-PERMIAN BASIN
NORTHWESTERN SHELF
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MIDLAND BASIN
CENTRAL PLAINS PLATFORM
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